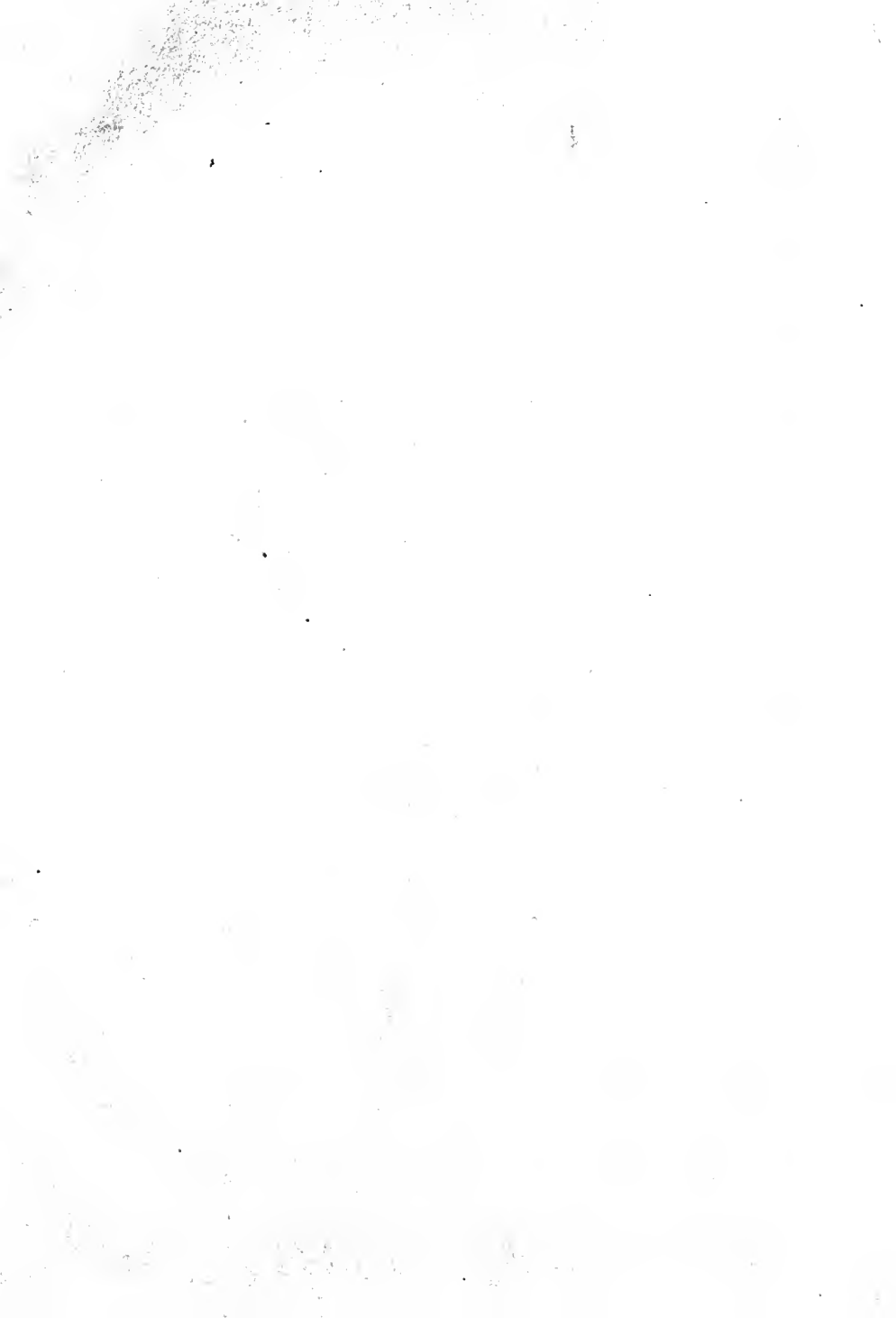
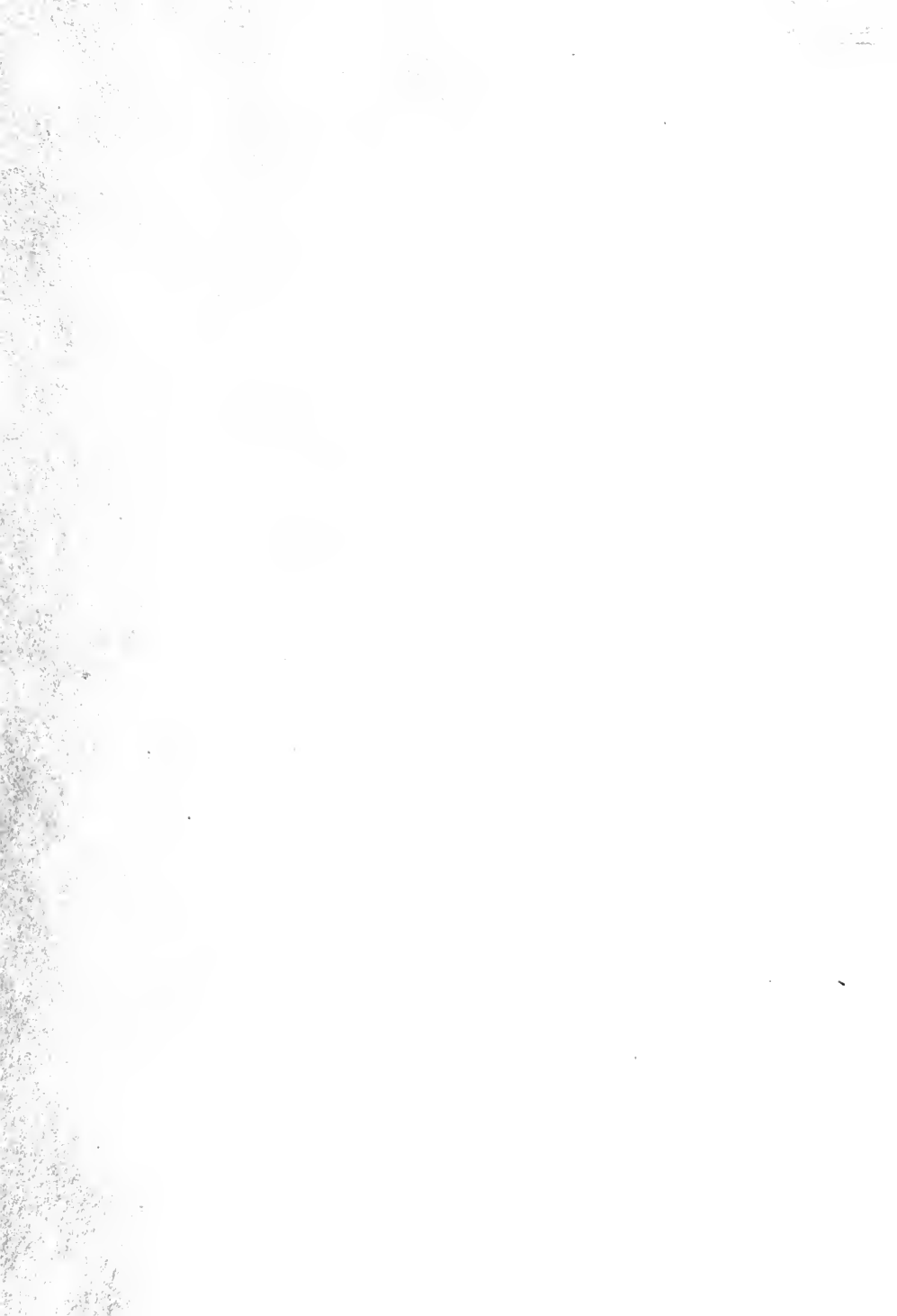


UNIVERSITY OF CALIFORNIA
AT LOS ANGELES









THE ROYAL SOCIETY
OF LONDON
OF NATURAL KNOWLEDGE
AND EXPERIMENTAL PHILOSOPHY

THE ROYAL SOCIETY

Let this Book, Intituled, *The History of the* ROYAL SOCIETY
of LONDON, *for the improving*
of Natural Knowledge, *be Printed.*

WILLIAM MORRICE.

THE
HISTORY
OF THE
ROYAL SOCIETY
OF
LONDON,

For the Improving of
NATURAL KNOWLEDGE.

By *THO. SPRAT*, D. D. late Lord
Bishop of ROCHESTER.

THE FOURTH EDITION.



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UNIV. OF CALIF.
AT LOS ANGELES

THE
HISTORICAL
SOCIETY
OF THE
ROYAL SOCIETY

FOR THE
PROMOTION OF
NATURAL KNOWLEDGE
AND THE
HISTORY OF NATURE



UNIVERSITY OF CALIFORNIA
AT LOS ANGELES

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1734



K I N G.

S I R,

O*f all the Kings of Europe, Your Majesty was the first, who confirm'd this noble Design of Experiments, by Your own Example, and by a publick Establishment. An Enterprize equal to the most renown'd Actions of the best Princes.*

The Epistle Dedicatory.

Princes. *For, to increase the Powers of all Mankind, and to free them from the Bondage of Errors, is greater Glory than to enlarge Empire, or to put Chains on the Necks of conquer'd Nations.*

What Reverence all Antiquity had for the Authors of natural Discoveries, is evident by the diviner Sort of Honour they conferr'd on them. Their Founders of philosophical Opinions were only admir'd by their own Sects: Their valiant Men and Generals did seldom rise higher than to Demy-Gods and Heroes: But the Gods they worshipped with Temples and Altars, were those who instructed the World to plow, to sow, to plant, to spin, to build Houses, and to find out new Countries. This Zeal indeed, by which they express'd their
Grati-

The Epistle Dedicatory.

Gratitude to such Benefactors, degenerated into Superstition; yet has it taught us, that a higher Degree of Reputation is due to Discoverers, than to the Teachers of speculative Doctrines, nay even to Conquerors themselves.

Nor has the true God himself omitted to shew his Value of vulgar Arts. In the whole History of the first Monarchs of the World, from Adam to Noah, there is no mention of their Wars, or their Victories: All that is recorded is this, they liv'd so many Years, and taught their Posterity to keep Sheep, to till the Ground, to plant Vineyards, to dwell in Tents, to build Cities, to play on the Harp and Organs, and to work in Brasses and Iron. And if they deserv'd a sacred Remembrance, for one natural

The Epistle Dedicatory.

tural *or* mechanical Invention, Your Majesty will certainly obtain immortal Fame, for having established a perpetual Succession of Inventors.

I am,

May it please your Majesty,

Your Majesty's most humble,

and most obedient

Subject and Servant,

THO. SPRATE.

TO THE
ROYAL SOCIETY.

I.

PHILOSOPHY, the great and only Heir
Of all that human Knowledge which has bin
Unforfeited by Man's rebellious Sin,
Though full of Years He do appear,
(Philosophy, I say, and call it, He,
For whatso'er the Painter's Fancy be,
It a male Virtue seems to me)
Has still been kept in Non-age till of late,
Nor manag'd or enjoy'd his vast Estate :
Three or four thousand Years one would have thought,
To Ripeness and Perfection might have brought
A Science so well bred and nurst,
And of such hopeful Parts too at the first.
But, oh! the Guardians and the Tutors then,
(Some negligent and some ambitious Men)
Would ne'er consent to set him free,
Or his own natural Powers to let him see,
Lest that should put an end to their Authoritie.

II.

That his own Business he might quite forget,
They amus'd him with the Sports of wanton Wit,
With the Deserts of Poetry they fed him,
Instead of solid Meats t'increase his Force;
Instead of vigorous Exercise, they led him
Into the pleasant Labyrinths of ever-fresh Discourse:
Instead of carrying him to see
The Riches which do boarded for him lye

*In Nature's endless Treasury,
 They chose his Eye to entertain
 (His curious but not-covetous Eye)
 With painted Scenes, and Pageants of the Brain.
 Some few exalted Spirits this latter Age has shown,
 That labour'd to assert the Liberty
 (From Guardians who were now Usurpers grown)
 Of this old Minor still, captiv'd Philosophy;
 But 'twas Rebellion call'd to fight
 For such a long oppressed Right.
 Bacon at last, a mighty Man, arose,
 Whom a wise King and Nature chose
 Lord Chancellor of both their Laws,
 And boldly undertook the injur'd Pupil's Cause.*

III.

*Authority, which did a Body boast,
 Though 'twas but Air condens'd, and stalk'd about,
 Like some old Giant's more gigantic Ghost,
 To terrify the learned Rout
 With the plain Magic of true Reason's Light,
 He chac'd out of our Sight,
 Nor suffer'd living Men to be misled
 By the vain Shadows of the Dead: (fled;
 To Graves, from whence it rose, the conquer'd Phantome
 He broke that monstrous God which stood
 In midst of th' Orchard, and the whole did claim,
 Which with a uselefs Scythe of Wood,
 And something else not worth a Name,
 (Both vast for Shew, yet neither fit
 Or to defend, or to beget;
 Ridiculous and senselefs Terrors!) made
 Children and superstitious Men afraid.
 The Orchard's open now, and free;
 Bacon has broke that Scare-crow Deity;*

*Come, enter, all that will,
 Behold the ripened Fruit, come gather now your Fill.
 Yet still, methinks, we fain would be
 Catching at the forbidden Tree,
 We would be like the Deity.
 When Truth and Falshood, Good and Evil, we
 Without the Senses Aid within our selves would see;
 For 'tis God only who can find
 All Nature in his Mind.*

IV.

*From Words, which are but Pictures of the Thought,
 (Though we our Thoughts from them perversly drew)
 To Things, the Mind's right Object, he it brought:
 Like foolish Birds to painted Grapes we flew;
 He sought and gather'd for our Use the true;
 And when on Heaps the chosen Bunches lay,
 He press'd them wisely the mechanic Way,
 Till all their Juice did in one Vessel join,
 Ferment into a Nourishment Divine,
 The thirsty Soul's refreshing Wine.
 Who to the Life an exact Piece would make,
 Must not from others Work a Copy take;
 No, not from Rubens or Vandike;
 Much less content himself to make it like
 Th' Ideas and the Images which lye
 In his own Fancy, or his Memory:
 No, he before his Sight must place,
 The natural and living Face;
 The real Object must command,
 Each Judgment of his Eye, and Motion of his Hand.*

V.

*From these and all long Errors of the Way,
 In which our wandring Predecessors went,
 And like th' old Hebrews many Years did stray,*

*In Desarts but of small Extent,
 Bacon, like Moses, led us forth at last,
 The barren Wilderneck be past,
 Did on the very Border stand
 Of the blest promis'd Land,
 And from the Mountain's Top of his exalted Wit,
 Saw it himself, and shew'd us it.
 But Life did never to one Man allow
 Time to discover Words, and conquer too;
 Nor can so short a Line sufficient be
 To fathom the vast Depth of Nature's Sea:
 The Work he did we ought t' admire,
 And were unjust if we should more require
 From his few Years, divided 'twixt th' Excess
 Of low Affliction and high Happiness:
 For who on Things remote can fix his Sight,
 That's always in a Triumph, or a Fight?*

VI.

*From you, great Champions, we expect to get
 These spacious Countries but discover'd yet;
 Countries where yet instead of Nature, we
 Her Images and Idols worship'd see:
 These large and wealthy Regions to subdue,
 Though Learning has whole Armies at Command,
 Quarter'd about in every Land,
 A better Troop she ne'er together drew.
 Methinks, like Gideon's little Band,
 God with Design has pick'd out you,
 To do these noble Wonders by a few:
 When the whole Host he saw, they are (said he)
 Too many to o'ercome for me;
 And now he chuses out his Men,
 Much in the way that he did then:
 Not those many whom he found
 Idly extended on the Ground,*

*To drink with their dejected Head
The Stream just so as by their Mouths it fled:
No, but those few who took the Waters up,
And made of their laborious Hands the Cup.*

VII.

*Thus you prepar'd, and in the glorious Fight
Their wondrous Pattern too you take:
Their old and empty Pitchers first they brake,
And with their Hands then lifted up the Light.
IO! Sound too the Trumpets here!
Already your victorious Lights appear;
New Scenes of Heaven already we espy,
And Crowds of golden Worlds on high;
Which from the spacious Plains of Earth and Sea,
Could never yet discover'd be
By Sailors or Chaldæans watchful Eye.
Nature's great Works no Distance can obscure,
No Smalness her near Objects can secure.
You've taught the curious Sight to press
Into the privatest Recess
Of her imperceptible Littleness.
She with much stranger Art than his who put
All th' Iliads in a Nut,
The numerous Work of Life does into Atoms shut.
You've learn'd to read the smallest Hand,
And well begun her deepest Sense to understand.*

VIII.

*Mischief and true Dishonour fall on those
Who would to Laughter or to Scorn expose
So virtuous and so noble a Design,
So human for its Use, for Knowledge so Divine.
The Things which these proud Men despise, and call
Impertinent, and vain, and small,*

*Those smallest Things of Nature let me know,
Rather than all their greatest Actions do.
Whoever would deposed Truth advance
Into the Throne usurp'd from it,
Must feel at first the Blows of Ignorance,
And the sharp Points of envious Wit,
So when by various Turns of the celestial Dance,
In many thousand Years
A Star so long unknown, appears,
Though Heaven it self more beauteous by it grow,
It troubles and alarms the World below,
Does to the Wise a Star to Fools a Meteor show.*

IX.

*With Courage and Success you the bold Work begin;
Your Cradle has not idle been:
None e'er but Hercules and you could be
At five Years Age worthy a History.
And ne'er did Fortune better yet
Th' Historian to the Story fit:
As you from all old Errors free
And purge the Body of Philosophy;
So from all modern Follies He
Has vindicated Eloquence and Wit.
His candid Style like a clean Stream does slide,
And his bright Fancy all the way
Does like the Sun-shine in it play;
It does like Thames, the best of Rivers, glide,
Where the God does not rudely overturn,
But gently pour the crystal Urn,
And with judicious Hand does the whole Current guide.
H' as all the Beauties Nature can impart,
And all the comely Dress without the Paint of Art.*

A. COWLEY.

AN
ADVERTISEMENT
TO THE
READER.

THE Reader is entreated to take Notice, that much of this Discourse was written and printed above two Years before the rest : For this Cause, in the first and second Books, he may chance to find some Expressions, that by reason of the difference of Time may seem not well to agree with the last : But those having pass'd the Press so long ago, were out of my Power of changing them ; and therefore I will refer it to his Kindness to do it for me.

I must also acquaint him, that in the Title of my Book I have taken a Liberty, which may be liable to Exception : I have call'd it a History of the Royal Society ; whereas the first Part wholly treats of the State of the Ancient Philosophy ; and the third chiefly contains a Defence and Recommendation of experimental Knowledge in general : So
that

that it is only the second Book that peculiarly describes their Undertaking. But for my Excuse I may alledge the Example of many of the Ancients, who have often from the principal Part of their Works given Title to all the rest : In their Imitation, though this Book does treat of many Subjects that are not Historical, yet I have presum'd to name the whole a History, because that was the main End of my Design.

The Style perhaps in which it is written, is larger and more contentious than becomes that Purity and Shortness which are the chief Beauties of historical Writings : But the Blame of this ought not so much to be laid upon me, as upon the Detractors of so noble an Institution : For their Objections and Cavils against it, did make it necessary for me to write of it, not altogether in the way of a plain History, but sometimes of an Apology.

(I)

THE
HISTORY
OF THE
Institution, Design, and Progress,
OF THE
ROYAL SOCIETY
OF
LONDON,

For the Advancement of experimental Philosophy.

The FIRST PART.



Shall here present to the World, an Sect. I.
Account of the *first Institution* of *The Preface,*
the *Royal Society*; and of the *Pro-* and *Design*
gress, which they have already made: *of this Dis-*
In hope, that this learned and in- *course,*
quisitive Age, will either think their
Indeavours worthy of its *Assistance*; or else will
be thereby provok'd, to attempt some *greater En-*
terprize (if any such can be found out) for the
A Bene-

The HISTORY of

Benefit of human Life, by the Advancement of *Real Knowledge*.

Perhaps this Task, which I have propos'd to my self, will incur the Censure of many judicious Men, who may think it an over-hasty and presumptuous Attempt; and may object to me, that the *History* of an Assembly which begins with so great Expectations, ought not to have been made publick so soon; till we could have produced very many considerable *Experiments*, which they had try'd, and so have given undeniable *Proofs* of the Usefulness of their Undertaking.

In answer to this, I can plead for my self, that what I am here to say, will be far from preventing the Labours of others in adorning so worthy a Subject; and is *premis'd* upon no other account, than as the noblest Buildings are first wont to be represented in a few *Shadows* or small *Models*; which are not intended to be equal to the chief Structure it self, but only to shew in little, by what *Materials*, with what *Charge*, and by how many *Hands*, that is afterwards to be rais'd. Although, therefore, I come to the Performance of this Work, with much less *Deliberation*, and *Ability*, than the *Weightiness* of it requires; yet I trust, that the *Greatness* of the *Design* it self, on which I am to speak, and the *Zeal* which I have for the *Honour* of our *Nation*, which have been the chief Reasons that have mov'd me to this Confidence of Writing, will serve to make something for my *Excuse*. For what greater matter can any Man desire, about which to employ his Thoughts, than the Beginnings of an *Illustrious Company*, which has already laid such excellent Foundations of so much Good to *Mankind*?

Or, what can be more delightful for an *English* Man to consider, than that notwithstanding all the late Miseries of his Country, it has been able in a short Time so well to recover it self, as not only to attain to the Perfection of its *former* Civility, and Learning, but also to set on foot a *new* Way of Improvement of Arts, as *great* and as *beneficial* (to say no more) as any the wittiest or the happiest Age has ever invented?

But besides this, I can also add, in my Defence, that though the *Society*, of which I aim to write, is not yet four Years old, and has been of necessity hitherto chiefly taken up, about *preparatory Affairs*; yet even in this Time, they have not wholly neglected their *principal End*, but have had Success, in the Trial of many remarkable Things; of which I doubt not, but I shall be able, as I pass along, to give Instances enough to satisfy the Curiosity of all *sober Inquirers* into Truth. And in short, if for no other End, yet certainly for this, a Relation of their first Original ought to be expos'd to the View of Men: That by laying down, on what course of Discovery they intend to proceed, the *Gentlemen of the Society* may be more solemnly engag'd, to *prosecute* the same. For now they will not be able, handsomely to draw back, and to forsake such honourable Intentions; when the World shall have taken notice, that so many prudent Men have gone so far, in a Business of this universal Importance, and have given such undoubted *Pledges* of many admirable Inventions to follow.

I shall therefore divide my Discourse into these three general Heads.

The HISTORY of

The *first* shall give a short View of the *Ancient* and *Modern* Philosophy; and of the most famous Attempts, that have been made for its *Advancement*: That by observing wherein others have *excell'd*, and wherein they have been thought to *fail*, we may the better shew, what is to be expected from these new Undertakers; and what moy'd them, to enter upon a Way of Inquiry, different from that, on which the former have proceeded.

The *second* shall consist of the *Narrative* it self: And out of their *Registers*, and *Journals*, which I have been permitted to peruse, shall relate the first Occasions of their Meetings, the Incouragement, and Patronage, which they have receiv'd; their *Patient*, their *Statutes*, the whole Order and Scheme of their *Design*, and the *Manner* of their Proceedings.

The *third* shall try, to assert the *Advantage* and *Innocence* of this Work, in Respect of all *Professions*, and especially of *Religion*; and how proper, above others, it is, for the present Temper of the *Age* wherein we live.

On the *first* and *last* of these Particulars, it is not needful that I should long insist: Because several *great Men* have already so much prevented me about them; that there is hardly any thing can be spoken, in which I shall not almost tread in their very *Footsteps*. But yet it is requisite, that something be here said to that purpose, though it be only in *Repetition*: Because I perceive, that there is still much prejudice remaining on many Men's Minds, towards any *new Discoveries* in *natural Things*. This I shall try to remove, not that I imagine, that those Reasons can have any great effect

fect in my *weak Hands*, which were not able fully to prevail, when they were inforc'd by the Eloquence of those *excellent Men* who have gone before me in this Argument: But I rather trust to the inclination of the *Age* it self, wherein I write; which (if I mistake not) is far more prepar'd to be perswaded to promote such Studies, than any other Time that has gone before us.

And first, let us observe the Practice of the best, Sect. III.
and the civilest Nations, amongst the *Ancients*; and The Philosophy of the East.
a little trace out the Course which they follow'd, to enrich their Countries, by the introducing of *Foreign Arts*, or a searching into *New*.

It is evident, from the universal Testimony of *History*, that all Learning and Civility were deriv'd down to us from the *Eastern* Parts of the World. There it was, that Mankind arose: and there they first discover'd the Ways of Living, with Safety, Convenience and Delight. It is but just, that we should attribute the original of *Astronomy, Geometry, Government*, and many Sorts of Manufactures, which we now enjoy, to the *Assyrians, the Chaldeans, and Egyptians*. And as to them we owe the *Invention*; so from them proceeded the first *Corruption* of Knowledge. It was the Custom of their wise Men, to wrap up their Observations on Nature, and the Manners of Men, in the dark Shadows of Hieroglyphicks; and to conceal them, as sacred Mysteries, from the Apprehensions of the Vulgar. This was a sure Way to beget a Reverence in the People's Hearts towards *themselves*: But not to advance the true Philosophy of *Nature*. That stands not in need of such Artifices to uphold its credit: But is then most likely

to

to thrive, when the Minds, and Labours of Men of all Conditions, are join'd to promote it, and when it becomes the Care of united Nations.

Into the *East*, the first inquisitive Men amongst the *Grecians* travelled: By what they observed there, they ripened their own imperfect Conceptions, and so returned to teach them at Home. And that they might the better insinuate their Opinions into their Hearers Minds, they set them off with the Mixture of *Fables* and the Ornaments of *Fancy*. Hence it came to pass, that the first Masters of Knowledge amongst them, were as well *Poets*, as *Philosophers*; for *Orpheus*, *Linus*, *Musæus*, and *Homer*, first softened Men's natural Rudeness; and by the Charms of their Numbers, allur'd them to be instructed by the severer Doctrines of *Solon*, *Thales*, and *Pythagoras*. This was a Course, that was useful at first, when Men were to be delightfully deceiv'd to their own Good: But perhaps it left some ill Influence on the whole Philosophy of their Successors; and gave the *Grecians* occasion ever after of exercising their Wit, and their Imagination, about the Works of Nature, more than was consistent with a sincere Inquiry into them.

Sect. IV. When the fabulous Age was past, *Philosophy* took a little more Courage; and ventured more to rely upon its own Strength, without the Assistance of *Poetry*. Now they began to gather into Assemblies, and to increase their Interest: and according to the different Temper of the *Grecians*, from the *Eastern* Nations, so were their Arts propagated in a different Way from theirs. The *Greeks*, being of a vigorous, and active Humour, establish'd their Philosophy

sophy in the *Walks*, and *Porches*, and *Gardens*, and such publick places about their Cities; whereas the graver and more reserv'd *Egyptians*, had confin'd it to their *Temples*.

In *Greece*, the most considerable (and indeed almost the only successful) Trials, that were made in this way, were at *Athens*; the Wit of whose Inhabitants, was, 'tis true, admirably fit for the reducing of Philosophy into *Method*, and for the adorning of it with the noblest Words, when once it had been before compleated in its Substance: But yet their Genius was not so well made, for the undergoing the first *Drudgery* and *Burden of Observation* which is needful for the *Beginning* of so difficult a Work. This will appear, if we remember, that they were the Masters of the Arts of *Speaking* to all their Neighbours; and so might well be inclin'd, rather to chuse such Opinions of Nature, which they might most elegantly express, than such, which were more useful, but could not so well be illustrated by the Ornaments of Speech. Besides this, their *City* was the general *School*, and Seat of *Education*; and therefore the Epitomes of Knowledge best served their turn, to make their Scholars, in a short time, finish the course of their Studies, and go home satisfied with a Belief of their own Proficiency, and their Teacher's Wisdom. They were also commonly (as most of the other *Grecians*) Men of hot, earnest, and hasty Minds; and so lov'd rather to make *sudden* Conclusions, and to convince their Hearers by Argument, than to *delay* long, before they fixt their Judgments; or to attend with sufficient Patience the Labour of Experiments. But to say no more, they had but a *narrow Territory*; and the condition

on of those times, would not allow a very large Commerce with foreign Nations: they were much exercis'd in the civil Affairs of their Country: they had almost a perpetual War at home, or abroad: which Kinds of busie and active Life breed Men up indeed for great Employments: but not so well for the diligent, private, and severe Examination of those little and almost infinite Curiosities, on which the true Philosophy must be founded.

SECT. V.
The Original
of the Phi-
losophical
Sects.

In that City therefore, the Knowledge of *Nature* had its Original, before either that of *Discourse*, or of *human Actions*; but it was quickly forc'd to give way to them both: For it was not yet come to a sufficient Ripeness, in the time of *Socrates*; and he, by the Authority of his admirable Wit, made all parts of Philosophy to be taken off from a Condition of encreasing much farther, that they might be immediately serviceable to the Affairs of Men, and the Uses of Life. He was one of the first Men, that began to draw into some Order, the confus'd and obscure Imaginations of those that went before him: and to make way for the composing of Arts, out of their scattered Observations. All these various Subjects, the Vastness of his Soul comprehended in his *casual Disputations*: but after his Death they were divided amongst his Followers, according to their several Inclinations. From him most of the succeeding *Sects* descended: and though every one of them had its different Principles and Rendezvous; yet they all laid claim to this one common Title of being *his Disciples*. By this means, there was a most specious Appearance of the Increase of Learning: all places were fill'd with Philosophical

Dis-

Disputes: Controversies were rais'd: Fashions were made: Many Subtilties of confuting, and defending, were invented: But so instead of joining all their Strength to overcome the Secrets of Nature (all which would have been little enough, though ever so wisely manag'd) they only did that, which has undone many such great Attempts; before they had yet fully conquer'd her, they fell into an open Dissension, to which of them her Spoils did belong.

'Tis true, at the same time, some few Men did continue an earnest, and laborious Pursuit, after *natural Causes, and Effects*; and took that Course, which, if it had met with as much Encouragement, as the others had, would without question have produc'd extraordinary Things. But these Philosophers digging deep out of the sight of Men; and studying more, how to *conceive* Things aright, than how to *set off*, and persuade their Conceptions, to others; were quickly almost quite overwhelm'd, by the more plausible and talkative Sects.

This was the success of that famous Age of the *Grecian* Learning, in respect of natural Knowledge. They stay'd not for an Information sufficient for such a noble Enterprize: They would not suffer their Posterity to have any Share with them, in the Honour of performing it: But too suddenly, for present Use, they clap'd up an entire Building of Sciences: And therefore it is not to be wonder'd, if the *hasty Fabrick*, which they rais'd, did not consist of the best Materials.

Sect. VI.
The Philosophy among the Romans.

But at last with their Empire, their Arts also were transported to *Rome*: The great Spirit of their Lawgivers, and Philosophers, in Course of Time, dege-

The HISTORY of

nerating into Rhetoricians, and wandring Teachers of the Opinions of their private Sects. Amongst the *Romans*, the Studies of Nature met with little, or no Entertainment. They scarce ever dream'd of any other Way of Philosophy, than only just reducing into new Method, and eloquently translating into their own Language, the Doctrines, which they had receiv'd from the *Greeks*. And it was a long time too, before even that could obtain any Countenance amongst them. For, in the first warlike and busy Ages of that State, they only apply'd themselves to a Severity of moral Virtue; endeavour'd after no other Skill, than that of the Customs, and Laws of their Country, the Ceremonies of their Religion, and the Arts of Government: Esteeming every Thing that came out of *Greece*, as an out-landish Fashion, which would corrupt the Manners of their Youth; and allure them, from that Strictness of Discipline, and Integrity of Life, by which they had enlarg'd the Bounds of their Common-wealth: 'Till at length their Power being increas'd, and their Minds a little softned by the Greatness of their Commands, and having tasted of the Pleasures of the East; they were content too, by degrees, to admit their Philosophy. And yet all the Use, that they made of it at last, was only, either that they might thereby make their Speech more plentiful; or else, that when they were at leisure from civil Affairs, they might have that as a Companion, and Comfort of their Retirements.

Sect. VII. This was the Condition of Philosophy, when the
The Philosophy of the Primitive Church, Christian Religion came into the World. That maintain'd it self in its first Age, by the Innocence, and
 Miracles,

Miracles, and Sufferings of its Founder, and his Apostles. But after their Deaths, when Christianity began to spread into the farthest Nations, and when the Power of working Wonders had ceas'd: It was thought necessary for its Increase, that its Professors should be able to defend it, against the Subtilities of the Heathens; by those same ways of Arguing, which were then in use, among the Heathen Philosophers. It was therefore on this Account, that the Fathers, and chief Doctors of our Church, apply'd themselves to the Peripatetick, and Platonick Sects; but chiefly to the Platonick: Because that seem'd to speak plainer about the Divine Nature; and also, because the Sweetness, and Powerfulness of *Plato's* Writings, did serve as well to make them popular Speakers, as Disputers. Having thus provided themselves against their Adversaries, they easily got the Victory over them: And though the idolatrous Gentiles had kept the Instruments of disputing, in their own Hands, so many hundred Years; yet they soon convinced them of the Ridiculousness of their Worship, and the Purity, and the Reasonableness of ours.

But now the Christians having had so good Success, against the Religions of the Heathens, by their own Weapons; instead of laying them down when they had done, unfortunately fell to manage them one against another. So many subtle Brains having been set on work, and warm'd against a foreign Enemy: When that was over, and they had nothing else to do (like an Army that returns victorious, and is not presently disbanded) they began to spoil, and quarrel amongst themselves. Hence that Religion, which at first appear'd so innocent, and peaceable,

The HISTORY of

and fitted for the Benefit of human Society ; which consisted in the plain, and direct Rules, of good Life, and Charity, and the Belief in a Redemption by one Saviour, was miserably divided into a thousand intricate Questions, which neither advance true Piety, nor good Manners. Hence arose all the Heresies of those times. Against these, besides the force of Disputation, the Church obtain'd the Arm of the Civil Magistrate : and so at last by the help of many General Councils, got them extinguish'd ; if I may say they were extinguish'd, seeing in this Age wherein we live, we have seen most of them unhappily revived. But still by this means, there was no Knowledge in Request, but the Disputative Philosophy. For while things were in this posture, and so many great Wits engag'd in the heats of Controversy : it was not to be expected, that they should look out for farther assistance, than the Arts, which were already prepar'd ; or that they should make any considerable Endeavours, about new Inventions, and the tedious Trial of Experiments. Nor can we much blame them for it : seeing in a time of War, every Man will rather snatch up that Armour which he finds ready made, than stay till Men go to the Mine, and dig out new Ore, and refine, and harden it a better way ; in hope to have his Weapons of a stronger, and nobler Metal at last.

Nor was that Age unfit for such an Enterprize, only on the Account of these Wars of the Tongue : But also by Reason of the miserable Distempers of the civil Affairs of the World, about that time : which were chiefly occasion'd by the *Roman* Army's usurping the Right of chusing Emperors, and by the Invasions of Barbarous Nations, which overwhelm'd the greatest Part of *Europe*. Amidst these Distractions,

it

it was impossible for any thing of this Nature to have prosper'd: And in so vast an Inundation of Ignorance, which carry'd away with it the very grown and aged Trees themselves (those Parts of Learning which had taken Root, so many Generations past) it would have been in vain, to have committed any new Plants to the Ground. Such Studies as these, as they must receive Encouragement from the Sovereign Authority, so they must come up in a peaceful Time, when Men's Minds are at Ease, and their Imaginations not disturb'd, with the Cares of preserving their Lives, and Fortunes.

To go on therefore with the Matter of Fact: Having left that dismal bloody Age we come into a Course of Time, which was indeed far quieter: But it was like the Quiet of the Night, which is dark withal. The Bishops of *Rome* taking the Opportunity of the Decay of the *Roman* Empire, had wrested from it so many Privileges, as did at last wholly destroy it: And while it was gasping for Life, forc'd it to make what Will and Testament they pleas'd. Being thus establish'd, and making *Rome*, whose Name was still venerable, the Seat of their Dominion, they soon obtain'd a Supremacy over the Western World. Under them for a long Space together Men lay in a profound Sleep. Of the universal Ignorance of those Times, let it suffice to take the Testimony of *William of Malmesbury*, one of our ancient *English* Historians, who says, that even amongst the Priests themselves, he was a Miracle that could understand *Latin*. Thus they continued; till at last, that Church adopted, and cherish'd some of the Peripatetic Opinions, which the most ingenious of the Monks,

Sect. VIII.
The Philosophy under the Church of Rome.

The HISTORY of

Monks, in their solitary and idle Course of Life, had lighted upon. This Sect was excellently well made for their Turn. For by hovering so much, in general Terms, and Notions, it amus'd Men's Minds, in Things that had not much Difficulty: And so the Laity being kept blind, were forc'd in all Things to depend on the Lips of the *Roman Clergy*. From that time even down to the *Reformation*, the *Gentlemen* of all these Countries, imploying themselves, chiefly in Arms and Adventures abroad: And the Books of the *Ancients*, being either destroy'd by the *Goths*, and *Vandals*; or those which escap'd their Fury, lying cover'd with Dust in the Libraries of *Monasteries*; few or none regarded any of the Arts of Wit, and Reason, besides the *Church-men*.

This, I will take the Boldness to say, must needs be very injurious to the Increase of *general Learning*. For though I shall justly affirm to the Honour of that *sacred Profession*, that all Knowledge has been more search'd into, and promoted by *them*, than by any other *Order* of Men, even from the *Egyptians* Times, (whose *Priests* in good part invented, or at least preserv'd, the Learning of the *East*) down to our present Age: Yet I must also add, that whenever all the studious Spirits of a Nation, have been reduc'd within the Temple's Walls, that Time is naturally liable to this Danger, of having its Genius more intent, on the different Opinions in *Religion*, and the Rites of Worship, than on the Increase of any other *Science*. Of this I shall give two Instances: one, from the *Ancients*, the other, from *our selves*.

It is manifest, that amongst the *Jews*, all the Men of Letters still apply'd themselves to the understanding of their *Law*: that being the publick Way

of Preferment, to the highest Places of Judicature and Authority in the State. For that many Fraternities were erected, and (as I may call them) *Judaical Monasteries* constituted. Hence came all the Interpretations on the Writings of their *great Law-giver* : Which at last grew so numerous, and various amongst themselves, that *Christ*, when he came, could hardly find any thing of *Moses his Mind*, in all they had writ : But performed more himself towards the Explanation of the *Law* in *two Chapters*, than they had done in all their infinite Volumes. But while they were so excessively busy, about such sorts of Contemplations, the other Parts of Learning were neglected : Little or no Footsteps of Philosophy remaining amongst them, except only the Memory of that *History of Plants*, which was not written by any of *Aaron's Family*, but by their *wisest King*.

But my other Instance comes nearer home, and it is of the *School-men*. Whose Works when I consider, it puts into my Thoughts, how far more importantly a good Method of Thinking, and a right Course of apprehending Things, does contribute towards the attaining of Perfection in true Knowledge, than the strongest, and most vigorous Wit in the World, can do without them. It cannot without Injustice be deny'd, that they were Men of extraordinary Strength of Mind : They had a great Quickness of Imagination, and Subtility of distinguishing : They very well understood the Consequence of Propositions : Their natural Endowments were excellent : Their Industry commendable : But they lighted on a wrong Path at first, and wanted Matter to contrive : And so, like the *Indians*, only express'd a wonderful

Sect. IX.
The Philosophy of the School-men.
Artifice,

Artifice, in the ordering of the same Feathers into a thousand Varieties of Figures. I will not insist long on the Barbarousness of their Stile ; though that too must justly be censur'd: For all the *ancient Philosophers*, though they labour'd not to be full and adorn'd in their Speech, yet they always strove to be easy, natural, and unaffected. *Plato* was allow'd by all to be the chief Master of *Speaking*, as well as of *Thinking*. And even *Aristotle* himself, whom alone these Men ador'd, however he has been since us'd by his *Commentators*, was so careful about his Words, that he was esteem'd one of the purest, and most polite Writers of his Time. But the want of good Language, not being the *School-men's* worst defect, I shall pass it over, and rather stop a little, to examine the *Matter* it self, and *Order* in which they proceeded.

The *Subjects* about which they were most conversant, were either some of those *Arts*, which *Aristotle* had drawn into Method, or the more speculative Parts of our *Divinity*. These they commonly handled after this Fashion. They began with some general Definitions of the Things themselves, according to their universal Natures, then divided them into their Parts, and drew them out into several Propositions, which they laid down as Problems: These they controverted on both sides ; and by many Niceties of Arguments, and Citations of Authorities, confuted their Adversaries, and strengthened their own Dictates. But though this notional War had been carry'd on with far more Care, and Calmness amongst them, than it was: Yet it was never able to do any great Good towards the Enlargement of Knowledge ; because it rely'd on *general Terms*, which

which had not much Foundation in *Nature*, and also because they took no other Course, but that of *Disputing*.

That this insisting altogether on establish'd *Axioms*, is not the most useful Way, is not only clear in such airy Conceptions, which they manag'd; but also in those Things, which lye before every Man's observation, which belong to the Life and Passions, and Manners of Men; which, one would think, might be sooner reduc'd into standing Rules. As for example; to make a prudent Man in the Affairs of State, it is not enough to be well vers'd in all the Conclusions, which all the *Politicians* in the World have devis'd, or to be expert in the Nature of Government and Laws, Obedience and Rebellion, Peace and War: Nay rather a Man that relies altogether on such universal Precepts, is almost certain to miscarry. But there must be a Sagacity of Judgment in particular Things; a Dexterity in discerning the Advantages of Occasions; a Study of the Humour, and Interest of the People he is to govern: The same is to be found in *Philosophy*; a thousand fine Argumentations, and Fabricks in the Mind, concerning the Nature of *Body*, *Quantity*, *Motion*, and the like, if they only hover a-loof, and are not squar'd to particular Matters, they may give an empty Satisfaction, but no Benefit, and rather serve to *swell*, than *fill* the Soul.

But besides this, the very way of *Disputing* itself, and inferring one Thing from another alone, is not at all proper for the spreading of Knowledge. It serves admirably well indeed, in those Arts, where the Connection between the Propositions is necessary, as in the *Mathematicks*, in which a long Train of *Demonstrations*, may be truly collected, from the certainty of

the first Foundation: But in things of probability only, it seldom or never happens, that after some little Progress, the main Subject is not left, and the Contenders fall not into other Matters, that are nothing to the Purpose: For if but one Link in the whole Chain be loose, they wander far away, and seldom, or never recover their first Ground again. In brief, *Disputing* is a very good Instrument to sharpen Men's Wits, and to make them versatile, and wary Defenders of the Principles, which they already know: but it can never much augment the *solid Substance of Science* itself: And methinks compar'd to *Experimenting*, it is like *Exercise* to the Body in Comparison of *Meat*: For Running, Walking, Wrestling, Shooting, and other such active Sports, will keep Men in Health, and Breath, and a vigorous Temper: but it must be a supply of new Food that must make them grow: so it is in this Case; much Contention, and Strife of Argument, will serve well to explain obscure things, and strengthen the weak, and give a good, sound, masculine Colour, to the whole Mass of Knowledge: But it must be a continued addition of *Observations*, which must nourish, and increase and give new Blood, and Flesh, to the *Arts* themselves.

But this has been only hitherto spoken, against the *Method* of the *School-men* in general; on supposition, that they took the best Course, that could be in that Kind. I shall now come to weigh that too. For it may easily be prov'd, that those very Theories, on which they built all their subtle Webs, were not at all collected, by a sufficient Information from the things themselves; which if it can be made out, I hope it will be granted, that the Force and Vigour of their Wit did more hurt, than good: and only

only serv'd to carry them the faster out of the right Way, when they were once going. The *Peripateticks* themselves do all grant, that the first Rise of Knowledge must be from the *Senses*, and from an Induction of their Reports: Well then; how could the *School-men* be proper for such a Business, who were ty'd by their Cloystral Life to such a Strictness of Hours, and had seldom any larger Prospects of *Nature*, than the Gardens of their *Monasteries*? It is a common Observation, that Men's Studies are various according to the different Courses of Life, to which they apply themselves; or the Tempers of the Places, wherein they live. They who are bred up in *Commonwealths*, where the greatest Affairs are manag'd by the Violence of popular Assemblies, and those govern'd by the most plausible Speakers, busy themselves chiefly about *Eloquence*; they who follow a *Court*, especially intend the Ornament of Language, and *Poetry*, and such more delicate Arts, which are usually there in most Request: they who retire from human things, and shut themselves up in a narrow Compass, keeping Company with a very few, and that too in a solemn way, addict themselves, for the most part, to some melancholy Contemplations, or to *Devotion*, and the Thoughts of another World. That therefore which was fittest for the *School-men's* way of life, we will allow them: But what sorry Kinds of Philosophy must they needs produce, when it was a part of their *Religion*, to separate themselves, as much as they could, from the Converse of Mankind? when they were so far from being able to discover the Secrets of *Nature*, that they had scarce Opportunity, to behold enough of its common Works. If any shall be inclinable to fol-

low the Directions of such Men in natural Things, rather than of those, who make it their Employment; I shall believe they will be irrational enough, to think, that a Man may draw an exacter Description of *England*, who has never been here, than the most industrious Mr. *Camden*, who had travell'd over every Part of this Country, for that very Purpose.

Whoever shall soberly profess, to be willing to put their Shoulders under the Burthen of so great an Enterprize, as to represent to Mankind the whole Fabrick, the Parts, the Causes, the Effects of Nature, ought to have their Eyes in all Parts, and to receive Information from every Quarter of the Earth; they ought to have a constant universal Intelligence; all Discoveries should be brought to them; the Treasuries of all former Times should be laid open before them; the Assistance of the present should be allow'd them: So far are the narrow Conceptions of a few private Writers, in a dark Age, from being equal to so vast a Design. There are indeed some Operations of the Mind, which may be best perform'd by the simple Strength of Men's own particular Thoughts; such are Invention, and Judgment, and Disposition: For in them a Security from Noise, leaves the Soul at more Liberty, to bring forth Order, and fashion the Heap of Matter, which had been before supply'd to its Use. But there are other Works also, which require as much Aid, and as many Hands, as can be found: And such is this of Observation; which is the great Foundation of Knowledge; some must gather, some must bring, some separate, some examine; and to use a Similitude, (which the present Time of the Year, and the ripe Fields; that lye before

before my Eyes, suggest to me) it is in *Philosophy*, as in *Husbandry*; wherein we see, that a few Hands will serve to measure out, and fill into Sacks, that Corn, which requires very many more Labourers, to sow, and reap, and bind, and bring it into the Barn.

But now it is time for me to dismiss this subtle Generation of Writers; whom I would not have prosecuted so far, but that they are still esteem'd by some Men, the only Masters of Reason. If they would be content with any thing less than an Empire in Learning, we would grant them very much. We would permit them to be great and profound Wits, as *Angelical*, and *Seraphical*, as they pleas'd: we would commend them, as we are wont to do *Chaucer*; we would confess, that they are admirable in Comparison of the Ignorance of their own Age: And, as Sir *Philip Sidney* said of him, we would say of them; that it is to be wonder'd, how they could see so clearly then, and we can see no clearer now: But that they should still be set before us, as the great Oracles of all Wit, we can never allow. Suppose, that I should grant, that they are most useful in the Controversies of our *Church*, to defend us against the Heresies, and Schisms of our Times; what will thence follow, but that they ought to be confin'd within their own Bounds, and not to be suffer'd to hinder the Enlargement of the Territories of other *Sciences*? Let them still prevail in the *Schools*, and let them govern in Disputations: But let them not over-spread all Sorts of Knowledge. That would be as ridiculous, as if, because we see, that Thorns, and Briers, by Reason of their Sharpness, are fit to stop a Gap, and keep out wild Beasts; we should therefore think, they deserv'd to be planted all over every Field.

And

And yet I should not doubt, (if it were not somewhat improper to the present Discourse) to prove, that even in *Divinity* it self, they are not so necessary, as they are reputed to be: and that all, or most of our Religious Controversies, may be as well decided, by plain Reason, and by Considerations, which may be fetch'd from the *Religion of Mankind*, the Nature of *Government*, and *human Society*, and *Scripture* it self, as by the Multitudes of Authorities, and Subtleties of Disputes, which have been heretofore in Use.

SECT. X.
The Restoration of
Learning.

And now I am come to the Time within our View and to the *third great Age* of the *flourishing of Learning*. Whether this Recovery of Knowledge did happen by the benefit of *Printing*, invented about that Time, which shew'd a very easy Way of communicating Men's Thoughts one to another; or whether it came from the Hatred, which was then generally conceiv'd against the Blindness, and Stupidity, of the *Roman Fryars*; or from the *Reformation*, which put Men upon a stricter Inquiry into the Truth of things; whatever the *Cause* was, I will not take much Pains to determine: but I will rather observe, what Kinds of Knowledge have most flourish'd upon it. If we compare this *Age of Learning*, with the *two former*; we shall find, that this does far exceed both the other in its Extent: there being a much larger Plat of Ground, sown with Arts and Civility at this time, than either when the *Grecian* or *Roman* Empires prevail'd. For then (especially under the *Romans*) so many Nations being united under one *Dominion*, and reduc'd into the Form of *Provinces*: that Knowledge which they had was chiefly confin'd

to the Walls of the *Imperial Cities* themselves. But now (not to insist on the Learning of far remote Countries, of which we have only imperfect Relations; but to contract our Observation to *Christendom* alone) there being so many different *States*, and *Governments* in *Europe*, every Country sets up for itself: almost in every place, the liberal Arts (as they are call'd) are cherish'd, and publick Allowance is made for their Support. And in this Compass, the infinite Numbers of Wits, which have appear'd so thick for these many Years, have been chiefly taken up about some of these three Studies; either the *Writings* of the *Antients*, or *Controversies* of *Religion*, or *Affairs of State*.

The first Thing that was undertaken, was to rescue the excellent Works of former *Writers* from Obscurity. To the better performing of this, many things contributed about that time. Amongst which, as to us in *England*, I may reckon (and that too, it may be, not the least, whatever the Action was in itself,) the Dissolution of *Abbies*: whereby their Libraries came forth into the Light; and fell into industrious Men's Hands, who understood how to make more Use of them, than their slothful Possessors had done. So that now the *Greek* and *Latin* Tongues began to be in Request; and all the ancient Authors, the *Heathen Philosophers*, *Mathematicians*, *Orators*, *Historians*, *Poets*, the various Copies, and Translations of the *Bible*, and the *Primitive Fathers* were produc'd. All these, by the several Transcriptions, and the Ignorance of the Transcribers, had very many different Readings, and many Parts wholly lost; and by the Distance of Times, and Change of Customs, were

Sect. XI.

The Recovery of the Antients.

were grown obscure. About the interpreting, explaining, supplying, commenting on these, almost all the first Wits were employed. A Work of great Use, and for which we ought to esteem our selves much beholden to them: For indeed, if they had not compleated that Business, to our Hands, we of this Age, had not been so much at Leisure, as now I hope we are, to prosecute new Inventions. If they had not done it, we should, of which we ought not to doubt, seeing we behold, that even now, when the Soil of Criticism is almost quite barren, and hardly another Crop will come, yet many learned Men cannot forbear spending their whole Labour in toyl- ing about it; what then should we have done, if all those Books had come down untouch'd to our Hands?

We cannot then, with any Sobriety, detract from the *Criticks*, and *Philologists*, whose Labours we enjoy. But we ought rather to give them this Testi- mony, that they were Men of admirable Diligence: and that the Collections, which they have made, out of the Monuments of the *Antients*, will be wonder- fully advantageus to us, if the right Use be made of them; if they be not set before us, only that we may spend our whole Lives in their Consideration, and to make the Course of Learning more difficult: But if they be imploy'd, to direct us in the Ways that we ought to proceed in Knowledge for the fu- ture; if by shewing us what has been already finish'd, they point out to us, the most probable Means, to accomplish what is behind. For methinks, that Wis- dom, which they fetch'd from the Ashes of the Dead, is something of the same Nature with Ashes them- selves; which, if they are kept up in Heaps together,

will be useless: But if they are scattered upon living Ground, they will make it more fertile, in the bringing forth of various Sorts of Fruits. To these Men then we are beholden, that we have a fairer Prospect about us: to them we owe, that we are not ignorant of the times that are gone before us; which to be, is (as *Tully* says) *to be always Children*. All this, and much more, is to be acknowledg'd: But then we shall also desire of them, that they would content themselves with what is their Due: that by what they have discover'd, amongst the Rubbish of the *Antients*, they would not condemn the Treasures, either lately found out, or still unknown; and that they would not prefer the *Gold* of *Ophir*, of which now there is no mention but in Books, before the present Mountains of the *West Indies*.

Thus I pass over this Sort of *reviv'd learning*. And now there comes into our View another remarkable Occasion of the Hindrance of the Growth of *experimental Philosophy*, within the Compass of this bright Age; and that is the great a-do which has been made, in raising, and confirming, and refuting so many different Sects, and Opinions of the *Christian Faith*. For whatever other Hurt or Good comes by such holy speculative Wars (of which whether the Benefit or Mischief over-weighs, I will not now examine) yet certainly by this means, the Knowledge of Nature has been very much retarded. And (to use that Metaphor, which an excellent *Poet* of our Nation turns to another purpose) that Shower has done very much Injury by falling on the Sea, for which the Shepherd and the Plough-man call'd in vain: The Wit of Men has been profusely pour'd out

Sect. XII.
Religious
Controversies
and Arts of
the Moderns.

on *Religion*, which needed not its help, and which was only thereby made more tempestuous; while it might have been more fruitfully spent, on some Parts of *Philosophy*, which have been hitherto barren, and might soon have been made fertile.

But besides this, there have been also several other *Professions*, which have drawn away the Inclinations of Men, from prosecuting the naked and uninterested Truth: And of these I shall chiefly name the *Affairs of State*, the Administration of civil Government, and the Execution of Laws. These by their fair Dowry of Gain and Honour, have always allur'd the greatest Part of the Men of Art, and Reason, to addict themselves to them: while the Search into severer Knowledge has been look'd on, as a Study out of the Way, fitter for a melancholy Humorist, or a retir'd weak Spirit, than to make Men equal to Business, or serviceable to their Country. And in this, methinks, the *experimental Philosophy* has met with very hard Usage: For it has commonly, in Men's Censures, undergone the Imputation of those very Faults, which it endeavours to correct in the *verbal*. That indeed may be justly condemn'd for filling Men's Thoughts with imaginary Ideas of Conceptions, that are no way answerable to the practical ends of Life: But this, on the other side, (as I shall shortly make out) is the surest Guide, against such notional Wandrings; opens our Eyes to perceive all the Realities of Things; and clears the Brain, not only from Darkness, but false or useless Light. This is certainly so in the Thing it self: But the greatest Part of Men have still apprehended the contrary. If they can bring such Inquirers under the scornful Titles of *Philosophers*, or *Scholars*, or *Virtuosi*, it is enough: They presently

sently conclude them to be Men of another World, only fit Companions for the Shadow, and their own melancholy Whimsies; looking on those who dig in the Mine of Nature, to be in as bad a Condition, as the *King of Spain's* Slaves in *Peru*, condemn'd for ever to that Drudgery, and never to be redeem'd to any other Imployment. And is not this a very unequal Proceeding? While some over-zealous *Divines* do reprobate natural Philosophy as a carnal Knowledge, and a too much minding worldly Things; the Men of the World, and Business, on the other side, esteem it merely as an idle Matter of Fancy, and as that which disables us from taking right Measures in human Affairs. Thus, by the one Party, it is censur'd for stooping too low; by the other, for soaring too high: so that, methinks, it is a good Ground to conclude, that it is guilty of neither of these Faults, seeing it is alike condemn'd by both the Extremes. But I shall have a fitter Occasion to examine this hereafter. However it be, it is not to be wonder'd, if Men have not been very zealous about those Studies, which have been so far removed from present Benefit, and from the Applause of Men. For what should incite them to bestow their Time, and Art, in revealing to Mankind those Mysteries, for which, it may be, they would be only despis'd at last? How few must there needs be, who will be willing to be impoverish'd for the common Good, while they shall see all the Rewards, which might give Life to their Industry passing by them, and bestow'd on the Deserts of easier Studies? and while they, for all their Pains, and publick Spirit, shall only perhaps be served, as the poor Man was in the *Fable*; who, while he went down into the Well, in Assurance,

that he should find a mighty Treasure there, was in the mean time robb'd by his Companions, that stay'd above, of his Cloak, and all the Booty that he had before gotten?

The Philosophy of the Moderns.

And yet, notwithstanding all these unfortunate Hindrances, there have been many commendable Attempts in this Way, in the Compass of our Memories, and the Age before us. And though they have been for the most part carry'd on, by the private Diligence of some few Men; in the midst of a thousand Difficulties, yet it will not be unprofitable to recount some of them; if it were only to give a fair Ground of Hope, how much Progress may be made by a form'd and regular *Assembly*, seeing some single Hands; with so small Encouragement, could dispatch so much of the Work.

There are five *new Ways of Philosophy*, that come into my Observation:

Sect. XIII. Modern Dogmatists.

The first is, of those, who, out of a just Disdain that the *Antients* should still possess a Tyranny over our Judgments, began first to put off the Reverence that Men had born to their Memories; and handling them more familiarly, made an exact Survey of their Imperfections: But then, having rejected them, they pursue their Success too far, and strait fell to form and impose new Theories on Men's Reason, with an Usurpation as great as that of the others: An Action, which we that live in this Age, may resemble to some things that we have seen acted on the Stage of the World: For we also have beheld the Pretenders to publick Liberty, turn the greatest *Tyrants* themselves. The first part of these Men's Performance is very much to be prais'd: They have made the

Ground open and clear for us; they have remov'd the Rubbish; which, when one great Fabrick is to be pull'd down, and another to be erected in its stead, is always esteem'd well nigh half the whole Work: Their Adventure was bold, and hazardous: They touch'd Men's Minds in their tenderest Part, when they strove to pluck off those Opinions, which had, by long Custom, been so closely twin'd about them: They freed our Understandings from the Charms of vain Apparitions, and a Slavery to dead Men's Names. And we may well guess, that the absolute Perfection of the *true Philosophy* is not now far off, seeing this first great and necessary Preparation for its coming, is already taken off our Hands. For methinks there is an Agreement, between the Growth of *Learning*, and of *Civil Government*. The Method of the Rise and Increase of that, was this: At first in every country there prevailed nothing but Barbarism and Rudeness: All places were terrible with *Giants*, and Enchantments, and insolent Usurpers: Against these there first arose some mighty *Heroes*, as *Hercules*, *Theseus*, and *Jason*: These scowr'd the World, redress'd Injuries, destroy'd Monsters; and for this they were made *Demi-gods*. But then they gave over, and it was left to the great Men, who succeeded them, as *Solon*, and *Lycurgus*, to accomplish the Work, to found Common-wealths, to give Laws, to put Justice in its Course: And why may I not now presume, (as many others have done before me) to reduce these Stories to a philosophical Sense? First then, the Phantasms, and Fairies, and venerable Images of Antiquity, did long haunt the World; against these we have had our Champions; and without all question, they had the better of the Cause;

Cause; and now we have good Ground to trust, that these Illusions being well over, the last finishing of this great Work is nigh at Hand, and is reserv'd for this Undertaking.

So then, thus far they did well. But in the second Part of their Enterprize, they themselves seem to me to have run into the same Mistake, for which we chiefly complain'd against those *Antients*, whose Authority they destroy'd. The greatest occasion of our dissenting from the *Greek Philosophers*, and especially from *Aristotle*, was, that they made too much Haste to seize on the Prize, before they were at the End of the Race; that they fix'd and determin'd their Judgments on general Conclusions too soon, and so could not afterwards alter them, by any new Appearances, which might represent themselves. And may not we suppose, that Posterity will have the same Quarrel at these Men's Labours? We do not fall foul upon Antiquity, out of any Singularity of Opinion, or a presumptuous Confidence of the Strength of our Wits above theirs; we admire the Men, but only dislike the Method of their Proceedings. And can we forbear murmuring, if we see our *Cotemporaries* disdain them, and yet imitate their Failings? If we must constitute a Sovereignty over our Reasons; I know not why we should not allow this Dominion to the *Antients*, rather than to any one of the Moderns. They are all dead long since; and though we should be over-reach'd by them in some few Falsehoods, yet there is no Danger, lest they should increase them upon us; whereas, if we once hang on the Lips of the wisest Men now living; we are still in their Power, and under their Discipline, and subject to be led by all their Dictates for the future. It

is true indeed, a diligent *Inquirer* of these Times may gather as much Experience, and in probability, conclude as rightly, as a whole *Academy*, or Sect of theirs could; yet I shall still deny, that any one Man, though he has the nimblest, and most universal Observation, can ever, in the Compass of his Life, lay up enough Knowledge, to suffice all that shall come after him to rest upon, without the Help of any new Inquiries.

And if we suppose the best, that some one Man, by wonderful Sagacity, or extraordinary Chance, shall light upon the true Principles of natural Philosophy; yet what will be the Profit of such universal Demonstrations, if they are only fitted for Talk, and the solving of Appearances? Will there be any great Matter, whether they are certain, or doubtful; old, or new; if they must be only bound-ed to a System, and confin'd to Discourse? The true Philosophy must be first of all begun, on a scrupulous, and severe Examination of Particulars: from them there may be some general Rules with great Caution drawn: But it must not rest there, nor is that the most difficult Part of its Course. It must advance those Principles, to the finding out of new Effects, through all the Varieties of Matter; and so both the Courses must proceed orderly together; from experimenting to demonstrating, and from demonstrating to experimenting again. I hope I shall content my Reader, if I only give one Instance in this Case. It is probable, that he who first discover'd, that all Things were order'd in *Nature* by *Motion*; went upon a better Ground, than any before him. But now if he will only manage this, by nicely disputing about the Nature, and Causes of

Motion.

Motion in general, and not prosecute it through all particular Bodies; to what will he at last arrive, But only to a better Sort of *Metaphysicks*? And it may be, his Followers, some Ages hence, will divide his Doctrine into as many Distinctions, as the *School-men* did that of *Matter* and *Form*; and so the whole Life of it will also vanish away into Air and Words, as that of theirs has already done.

SECT. XIV. But it is time for me to give over this Argument; *The ill effects in which, I fear, that what I have already said, will alarm some excellent Men, whose Abilities I admire; who may perhaps suspect, that it has been with a particular Reflection. I might say for my self, that first they must pass Sentence on themselves, before they can think so, seeing I have nam'd no Man. But I will rather sincerely profess, that I had no satyrical Sense, but only declar'd against Dogmatists in general. And I cannot repent my having done it, while I perceive there are two very dangerous Mischiefs, which are caus'd by that way of Philosophy. The one is, that it makes Men give over, and believe that they are satisfy'd, too soon. This is of very ill Consequence; for thereby Men's Industry will be slackned, and all the Motives to any farther Pursuit taken away. And indeed this is an Error, which is very natural to Men's Minds; they love not a long and a tedious Doubting, though it brings them at last to a real Certainty; but they choose rather to conclude presently, than to be long in Suspence, though to better purpose. And it is with most Men's Understandings, as with their Eyes; to which those seem more delightful Prospects, where Varieties of Hills and Woods do soon bound their Wandrings, than where there is one large*

large smooth *Champagn*, over which they may see much farther, but where there is nothing to delay, and stop, and divert the Sight.

But the other ill Effect, of which I shall take notice, is, that it commonly inclines such Men, who think themselves already resolved, and immoveable in their Opinions, to be more imperious, and impatient of Contradiction, than becomes the Calmness, and unpassionate Evenness of the true philosophical Spirit. It makes them prone to undervalue other Mens Labours, and to neglect the real Advantage, that may be gotten by their Assistance; lest they should seem to darken their own Glory. This is a Temper of Mind of all others the most pernicious; to which I may chiefly attribute the Slowness of the Increase of Knowledge amongst Men. For what great Things can be expected, if Mens Understandings shall be as it were always in the warlike State of Nature, one against another? If every one be jealous of another's Inventions, and still ready to put a Stop to his Conquests? Will there not be the same wild Condition in Learning, which had been amongst Men, if they had always been dispers'd, still preying upon and spoiling their Neighbours? If that had still continued, no Cities had been built, no Trades found out, no Civility taught: For all these noble Productions came from Men's joining in Compacts, and entering into *Society*. It is an usual saying, that *where the natural Philosopher ends, the Physician must begin*: And I will also add, that *the natural Philosopher is to begin, where the moral ends*. It is requisite, that he who goes about such an Undertaking, should first know himself, should be well practis'd in all the modest, humble, friendly Virtues; should be willing

to be taught, and to give way to the Judgment of others. And I dare boldly say, that a plain industrious Man, so prepar'd, is more likely to make a good Philosopher, than all the high, earnest, insulting Wits, who can bear neither Partnership, nor Opposition: The *Chymists* lay it down, as a necessary Qualification of their happy Man, to whom God will reveal their ador'd *Elixir*, that he must be rather innocent, and virtuous, than knowing. And if I were to form the Character of a true Philosopher, I would be sure to make that the Foundation: Not that I believe, God will bestow any extraordinary Light in Nature, on such Men more than others; but upon a bare rational Account: For certainly, such Men, whose Minds are so soft, so yielding, so

* complying, so large, are in a far better Way, than the bold and haughty Asserters: they will pass by nothing, by which they may learn; they will be always ready to receive, and communicate Observations; they will not condemn the Fruits of others Diligence; they will rejoice to see Mankind benefited, whether it be by themselves or others.

Sect. XV. The second Endeavours have been of those, who
The Revivers of the Ancient Sects, renounc'd the Authority of *Aristotle*; but then restor'd some one or other of the *Ancient Sects* in his stead. If such Mens Intentions were only, that we might have before us the Conceptions of several Men of different Ages, upon the Works of Nature, without obliging us to an implicit Consent to all that they affirm; then their Labours ought to be receiv'd with great Acknowledgments: For such a general Prospect will very much enlarge, and guide our Inquiry; and perhaps also will help to hinder the Age

7.

from

from ever falling back again into a Subjection to one usurping Philosopher. But if their Purpose was, to erect those Schools which they reviv'd, into as absolute a Power, as the *Peripateticks* had heretofore; if they strive to make a Competition between *Aristotle* and *Epicurus*, or *Democritus*, or *Philolaus*; they do not contribute very much, towards the main Design: For towards that, it is not enough, that the *Tyrant* be chang'd; but the *Tyranny* it self must be wholly taken away.

The *third* Sort of *new Philosophers* have been those, who have not only disagreed from the *Antients*, but have also propos'd to themselves the right Course of slow and sure *Experimenting*; and have prosecuted it as far, as the Shortness of their own Lives, or the Multiplicity of their other Affairs, or the Narrowness of their Fortunes, have given them leave. Such as these we are to expect to be but few; for they must divest themselves of many vain Conceptions, and overcome a thousand false Images, which lye like Monsters in their Way, before they can get as far as this. And of these, I shall only mention one great Man, who had the true Imagination of the whole Extent of this Enterprize, as it is now set on foot; and that is, the Lord *Bacon*; in whose Books there are every where scattered the best Arguments, that can be produc'd for the Defence of experimental Philosophy, and the best Directions, that are needful to promote it: All which he has already adorn'd with so much Art; that if my Desires could have prevailed with some excellent Friends of mine, who engag'd me to this Work, there should have been no other Preface to the *History of the Royal Society*,
Sect. XVI.
Modern Experimenters.

ciety, but some of his Writings. But methinks, in this one Man, I do at once find enough Occasion, to admire the Strength of human Wit, and to bewail the Weakness of a mortal Condition. For is it not wonderful, that he, who had run through all the Degrees of that *Profession*, which usually takes up Men's whole Time; who had studied, and practis'd, and govern'd the *common Law*; who had always liv'd in the Crowd, and born the greatest Burden of civil Business; should yet find Leisure enough for these retir'd Studies, to excel all those Men, who separate themselves for this very purpose? He was a Man of strong, clear, and powerful Imaginations; his Genius was searching and inimitable; and of this I need give no other Proof than his Style it self; which as, for the most part, it describes Men's Minds, as well as Pictures do their Bodies, so did his above all Men living. The Course of it vigorous, and majestic; the Wit bold, and familiar; the Comparisons fetch'd out of the Way, and yet the more easy: In all expressing a Soul, equally skill'd in Men, and Nature. All this and much more is true of him; but yet his *Philosophical Works* do shew, that a single and busy Hand can never grasp all this whole Design, of which we treat. His Rules were admirable; yet his *History* not so faithful, as might have been wish'd, in many Places; he seems rather to take all that comes, than to choose, and to heap, rather than to register. But I hope this Accusation of mine can be no great Injury to his Memory; seeing, at the same time, that I say he had not the Strength of a thousand Men, I do also allow him to have had as much as twenty.

The next Philosophers, whom I shall touch upon, are the *Chymists*, who have been more numerous, in this latter Age, than ever before. And without question, they have lighted upon the right Instrument of great Productions and Alterations; which must for the most part be perform'd by Fire. They may be divided into three Ranks: Such, as look after the Knowledge of Nature in general; such, as seek out, and prepare Medicines; and such, as search after Riches, by Transmutations, and the great *Elixir*. The two first have been very successful, in separating, compounding, and changing the Parts of Things; and in shewing the admirable Powers of Nature, in the raising of new Consistencies, Figures, Colours, and Virtues of Bodies: And from their Labours, the true *Philosophy* is like to receive the noblest Improvements. But the Pretensions of the third Kind are, not only to indow us with all the Benefits of this Life, but with Immortality it self: And their Success has been as small, as their Design was extravagant. Their Writers involve them in such Darkness; that I scarce know, which was the greatest Task, to understand their Meaning, or to effect it. And in the Chase of the *Philosopher's Stone*, they are so earnest, that they are scarce capable of any other Thoughts; so that if an Experiment lye ever so little out of their Road, it is free from their Discovery; as I have heard of some Creatures in *Africk*, which still going a violent Pace strait on, and not being able to turn themselves, can never get any Prey, but what they meet just in their Way. This Secret they prosecute so impetuously, that they believe they see some Footsteps of it, in every Line of *Moses*, *Solomon*, or *Virgil*. The Truth is, they are downright *Enthusiasts* about

Sect. XVII.
The Chy-
mists.

about it. And seeing we cast *Enthusiasm* out of *Divinity* it self, we shall hardly sure be persuaded, to admit it into Philosophy. It were perhaps a vain Attempt, to try to cure such Men of their groundless Hopes. It may be they are happier now, as they are: And they would only cry out with the Man in *Horace*, that their Friends, who had restor'd them to a perfect Sense, had murder'd them. But certainly, if they could be brought to content themselves with moderate Things, to grow rich by Degrees, and not to imagine, they shall gain the *Indies* out of every *Crucible*; there might be wonderful Things expected from them. And of this we have good assurance, by what is come abroad from diverse eminent Persons; amongst whom some are Members of the *Royal Society*. And, if it were not already excellently perform'd by others, I might here speak largely, of the Advantages that accrue to Physick, by the industrious Labours of such *Chymists*, as have only the discreet, and sober Flame, and not the wild Lightning of the others Brains.

Sect. XVIII. But the last Kind, that I shall name, has been of those, who conscious of human Frailty, and of the Vastness of the Design of an *universal Philosophy*, have separated, and chosen out for themselves, some particular Subjects, about which to bestow their Diligence. In these, there was less Hazard of Failing; these by one Man's Industry, and constant Indeavours, might probably at last be overcome: And indeed they have generally reap'd the Fruits of their Modesty. I have but one thing to except against some few of them; that they have been sometimes a little too forward to conclude upon *Axioms*, from what they

they have found out, in some particular Body. But that is a Fault, which ought to be overwhelm'd by their other Praises : And I shall boldly affirm, that if all other Philosophical Matters had been as well and as throughly sifted, as some admirable Men of this Age have manag'd some parts of *Astronomy*, *Geometry*, *Anatomy*, &c. there would scarce any Burden have remained on the Shoulders of our Posterity ; but they might have sat quietly down, and enjoy'd the Pleasure of the true *Speculative* Philosophy, and the Profit of the *Practical*.

To all these Proceedings, that I have mention'd there is as much Honour to be paid, as can be due to any one single human Wit : But they must pardon us, if we still prefer the joint Force of many Men.

And now it is much to be wondred, that there was never yet such an *Assembly* erected, which might proceed on some standing Constitutions of Experimenting. There have, 'tis true, of late, in many Parts of *Europe*, some Gentlemen met together, submitted to common Laws, and form'd themselves into *Academies* : But it has been, for the most Part, to a far different Purpose ; and most of them only aim'd at the smoothing of their Style, and the Language of their Country. Of these, the first arose in *Italy* : where they have since so much abounded, that there was scarce any one great City without one of these *Combinations*. But that, which excell'd all the other, and kept it self longer untainted from the Corruptions of Speech, was the *French Academy* at *Paris*. This was compos'd of the noblest Authors of that Nation ; and had for its *Founder*, the *Great Cardinal de Richelieu* : who, amongst all his *Cares*, whereby he establish'd,

Sect. XIX.
Modern Academies for Language.

blish'd and enlarg'd that *Monarchy* so much, did often refresh himself by directing, and taking an Account of their Progress. And indeed in his own Life he found so great Success of this Institution, that he saw the *French Tongue* abundantly purified, and beginning to take place in the Western World, almost as much as the *Greek* did of old, when it was the Language of Merchants, Soldiers, Courtiers, and Travellers. But I shall say no more of this *Academy*, that I may not deprive my Reader of the Delight of perusing their own *History*, written by *Monsieur de Pelisson*; which is so masculine, so chastly, and so unaffectedly done, that I can hardly forbear envying the *French Nation* this Honour; that while the *English Royal Society* has so much out-gone their *Illustrious Academy*, in the Greatness of its Undertaking, it should be so far short of them in the Abilities of its *Historian*. I have only this to alledge in my Excuse; that as they undertook the Advancement of the Elegance of Speech, so it became their *History* to have some Resemblance to their Enterprize: Whereas the Intention of ours being not the Artifice of Words, but a bare Knowledge of Things; my Fault may be esteem'd the less, that I have written of *Philosophers* without any Ornament of *Eloquence*.

Sect. XX.
A Proposal
for erecting
an English
Academy.

I hope now it will not be thought a vain Digression, if I step a little aside, to recommend the forming of such an *Assembly* to the Gentlemen of our Nation. I know indeed, that the *English Genius* is not so airy and discursive, as that of some of our Neighbours, but that we generally love to have Reason set out in plain undeceiving Expressions; as much as they to have it deliver'd with Colour and Beauty. And besides

sides this, I understand well enough, that they have one great Assistance to the Growth of Oratory, which to us is wanting: that is, that their Nobility live commonly close together in their Cities, and ours for the most part scattered in their Country Houses. For the same reason, why our Streets are not so well built as theirs, will hold also, for their exceeding us in the Arts of Speech: They prefer the Pleasures of the Town, we those of the Field; whereas it is from the frequent Conversations in Cities, that the Humour, and Wit, and Variety, and Elegance of Language, are chiefly to be fetch'd. But yet, notwithstanding these Discouragements, I shall not stick to say, that such a Project is now seasonable to be set on foot, and may make a great Reformation in the manner of our Speaking and Writing. First, the Thing itself is no way contemptible: For the Purity of Speech, and Greatness of Empire have, in all Countries, still met together. The *Greeks* spake best, when they were in their Glory of Conquest. The *Romans* made those Times the Standard of their Wit, when they subdued, and gave Laws to the World: And from thence, by degrees, they declin'd to Corruption, as their Valour, their Prudence, and the Honour of their Arms did decay; and at last, did even meet the *Northern Nations* half way in *Barbarism*, a little before they were overrun by their *Armies*.

But besides, if we observe well the *English Language*, we shall find, that it seems at this time, more than others, to require some such Aid, to bring it to its last Perfection. The Truth is, it has been hitherto a little too carelessly handled; and, I think, has had less Labour spent about its polishing than it de-

serves. Till the time of *King Henry the Eighth*, there was scarce any Man regarded it, but *Chaucer*; and nothing was written in it, which one would be willing to read twice, but some of his *Poetry*. But then it began to raise itself a little, and to sound tolerably well. From that Age, down to the beginning of our late *Civil Wars*, it was still fashioning, and beautifying itself. In the Wars themselves, which is a time wherein all Languages use, if ever, to increase by extraordinary degrees; (for in such busie and active times, there arise more new Thoughts of Men, which must be signified, and varied by new Expressions) then, I say, it receiv'd many fantastical Terms, which were introduc'd by our *Religious Sects*; and many outlandish Phrases, which several *Writers*, and *Translators*, in that great Hurry, brought in, and made free as they pleas'd, and withal it was enlarg'd by many sound and necessary Forms and Idioms, which it before wanted. And now, when Men's Minds are somewhat settled, their Passions allay'd, and the peace of our Country gives us the Opportunity of such Diversions; if some sober and judicious Men would take the whole Mass of our Language into their Hands, as they find it, and would set a Mark on the ill Words, correct those which are to be retain'd, admit and establish the good, and make some Emendations in the Accent and Grammar: I dare pronounce, that our *Speech* would quickly arrive at as much Plenty, as it is capable to receive; and at the greatest Smoothness, which its Derivation from the rough *German* will allow it.

Nor would I have this new *English Academy* confin'd only to the weighing Words and Letters; but there may be also greater Works found out for it. By
many

many Signs we may guess, that the Wits of our Nation are not inferior to any other; and that they have an excellent Mixture of the Spirit of the *French* and the *Spaniard*: and I am confident, that we only want a few more standing Examples, and a little more Familiarity with the Antients to excell all the Moderns. Now the best Means that can be devis'd to bring that about, is to settle a fixt and *impartial Court of Eloquence*; according to whose Censure, all Books, or Authors, should either stand or fall. And above all, there might be recommended to them one principal Work, in which we are yet defective; and that is, the compiling of a *History* of our late *Civil Wars*. Of all the Labours of Men's Wit and Industry, I scarce know any that can be more useful to the World than *Civil History*; if it were written, with that Sincerity and Majesty, as it ought to be, as a faithful Idea of human Actions. And it is observable, that almost in all civilis'd Countries, it has been the last thing, that has come to Perfection. I may now say, that the *English* can already shew many industrious and worthy Pieces in this kind: But yet, I have some propheticall Imagination in my Thoughts, that there is still behind something greater than any we have yet seen, reserv'd for the Glory of this Age. One Reason of this my strong Persuasion is a Comparison, that I make, between the Condition of our *State*, and that of the *Romans*. They at first wrote, in this way, not much better than our *Monks*: only registering, in an undigested manner, some few naked Breviaries of their Wars, and Leagues, and Acts of their City Magistrates. And indeed they advanc'd forward by very slow Degrees: For I remember, that *Tully* somewhere complains, in these

Words: *Historia nondum Latinis Literis illustrata.*

But it was the peaceful Reign of *Augustus*, after the Conclusion of their long Civil Wars, the most of their perfect *Historians* appear'd. And it seems to me, that we may expect the same Progress amongst us. There lye now ready in Bank the most memorable Actions of twenty Years; a Subject of as great Dignity and Variety, as ever pass'd under any Man's Hands; the Peace which we enjoy, gives Leisure and Encouragement enough; the Effects of such a Work would be wonderfully advantageous to the Safety of our Country, and to *His Majesty's* Interest: for there can be no better Means to preserve his Subjects in Obedience for the future, than to give them a full View of the Miseries that attend Rebellion. There are only therefore wanting for the finishing of so brave an Undertaking, the united Endeavours of some publick Minds, who are conversant both in Letters and Business: and if it were appointed to be the Labour of one or two Men to compose it, and of such an *Assembly* to revise and correct it, it might certainly challenge all the Writings of past or present Times.

But, I see, I have already transgress'd: for I know it will be thought unadvisedly done, while I was inforcing a weightier Design, to start, and to follow another of less Moment. I shall therefore let it pass as an extravagant Conceit: only I shall affirm, that the *Royal Society* is so far from being like to put a Stop to such a Business, that I know many of its Members, who are as able as any others, to assist in the bringing it into Practice.

Thus I have dispatch'd my first general Head; in which, it may be, it was not needful to have staid so long:

long; seeing, I am confident, I have said nothing, but what was before very well known, and what passes about in common Discourse.

I did on purpose omit the *learned Age* of the *Ara-* Se&t. XXI.
bians, in its proper Place; because I was resolved, The Philoso-
 as I came down, to keep my self as near as I could, phy of the A-
 within the Bounds of *Christendom*. But I shall now rabians.
 add, concerning them, that their Studies also were
 principally bent upon expounding *Aristotle*, and
 the *Greek Physicians*. They were, without Question,
 Men of a deep and subtile Wit; which is a Charac-
 ter, that (it may be) in all Ages has belonged more
 justly to the Tempers of the Southern, than of the
 Northern Countries. Of this they have left many no-
 ble Testimonies behind them; so many, that (if we
 believe some worthy and industrious Men of our own
 Nation, who have searched into their Monuments)
 they might even almost be compared to *Rome* and
Athens themselves. But they enjoyed not the Light
 long enough: It brake forth upon the Point of
 their greatest Conquests; it mainly consisted, in un-
 derstanding the Ancients; and what they would have
 done, when they had been weary of them we can-
 not tell: For that Work was not fully over, before
 they were darkened by that, which made even *Greece*
 it self barbarous, the *Turkish Monarchy*. However,
 that Knowledge, which they had, is the more re-
 markable, because it sprang up, in that Part of the
 World, which has been almost always perversly un-
 learned. For methinks, that small Spot of civil Arts,
 compared to their long Course of Ignorance, before
 and after, bears some Resemblance with that Country
 it self; where there are some few little Vallies, and
 Wells,

Wells, and pleasant Shades of *Palm-Trees*; but those lying in the midst of Deserts, and unpassable Tracts of Sands.

SECT. XXII. But now it being a fit Time to stop, and breathe a while, and take a Review of the Ground, that we have passed. It would be here needful for me to make an Apology for my self, in a Matter, which, if it be not beforehand remov'd, may chance to be very prejudicial to Men's good Opinion of the *Royal Society* itself, as well as of its *Historian*. I fear, that this *Assembly* will receive Disadvantage enough, from my weak Management of their Cause, in many other Particulars; so that I must not leave them, and myself unjustified, in this, wherein we have so much Right on our Sides. I doubt not then, but it will come into the Thoughts of many *Criticks* (of whom the World is now full) to urge against us, that I have spoken a little too sparingly of the Merits of former Ages; and that this Design seems to be promoted, with a malicious Intention of disgracing the Merits of the *Ancients*.

But first, I shall beseech them, calmly to consider; whether they themselves do not more injure those great Men, whom they would make the Masters of our Judgments, by attributing all Things to them so absolutely; than we, who do them all the Justice we can, without adoring them? It is always esteemed the greatest Mischief a Man can do those whom he loves, to raise Men's Expectations of them too high, by undue and impertinent Commendations. For thereby not only their Enemies, but indifferent Men, will be secretly inclined to be more watchful over their Failings, and to conspire in beating down their
 4 Fame.

Fame. What then can be more dangerous to the Honour of Antiquity ; than to set its Value at such a Rate, and to extol it so extravagantly, that it can never be able to bear the Trial, not only of envious, but even of impartial Judges? It is natural to Men's Minds, when they perceive others to arrogate more to themselves, than is their Share ; to deny them even that, which else they would confess to be their Right. And of the Truth of this, we have an Instance of far greater Concernment, than that which is before us : And that is, in *Religion* itself. For while the *Bishops* of *Rome* did assume an Infallibility, and a sovereign Dominion over our Faith ; the *reformed Churches* did not only justly refuse to grant them that, but some of them thought themselves obliged to forbear all Communion with them, and would not give them that Respect, which possibly might belong to so ancient and so famous a *Church* ; and which might still have been allowed it, without any Danger of Superstition.

But to carry this Dispute a little farther ; what is this, of which they accuse us ? They charge us with Immodesty in neglecting the Guidance of wiser and more discerning Men, than our selves. But is not this rather the greatest Sign of Modesty, to confess, that we our selves may err, and all Mankind besides ? To acknowledge the Difficulties of Science ; and to submit our Minds to all the least Works of Nature ? What kind of Behaviour do they exact from us in this Case ? That we should reverence the Footsteps of *Antiquity* ? We do it most unanimously. That we should subscribe to their Sense, before our own ? We are willing, in Probabilities ; but we cannot, in Matters of Fact ; for in them we follow the most ancient

Author

Author of all others, even *Nature* it self. Would they have us make our Eyes behold Things, at no farther Distance, than they saw? That is impossible; seeing we have the Advantage of standing upon their Shoulders. They say, it is Insolence, to prefer our own Inventions before those of our *Ancestors*. But do not even they the very same Thing themselves, in all the pretty Matters of Life? In the Arts of War, and Government; in the making, and abolishing of Laws; nay even in the Fashion of their Cloaths, they differ from them, as their Humour or Fancy leads them. We approach the Ancients, as we behold their Tombs with Veneration; but we would not therefore be confined to live in them altogether; nor would (I believe) any of those, who profess to be more addicted to their Memories. They tell us, that in this Corruption of Manners, and Sloth of Men's Minds, we cannot go beyond those, who searched so diligently, and concluded so warily before us. But in this they are confuted by every Day's Experience. They object to us *Tradition*, and the Consent of all Ages. But do we not yet know the Deceitfulness of such Words? Is any Man, that is acquainted with the Craft of founding *Seets*, or of managing Votes in *popular Assemblies*, ignorant, how easy it is to carry Things in a violent Stream? And when an Opinion has once master'd its first Opposers, and settled itself in Men's Passions or Interests; how few there be, that coldly consider, what they admit for a long time after? So that when they say, that *all Antiquity* is against us, 'tis true, in shew, they object to us the Wisdom of many Ages; but in reality, they only confront us, with the Authority of a few leading Men. Nay, what if I should say, that this Honour for
the

the dead, which such Men pretend to, is rather a worshipping of themselves, than of the *Antients*? It may be well prov'd, that they are more in Love with their own *Commentaries*, than with the *Texts* of those, whom they seem to make their Oracles; and that they chiefly doat on those Theories, which they themselves have drawn from them; which, it is likely, are almost as far distant from the original Meaning of their *Authors*, as the Positions of the *new Philosophers* themselves.

But to conclude this Argument (for I am weary of walking in a Road so trodden) I think I am able to confute such Men by the Practice of those very *Antients*, to whom they stoop so low. Did not they trust themselves, and their own Reasons? Did not they busie themselves in Inquiry, make new Arts, establish new Tenets, overthrow the old, and order all Things as they pleas'd, without any servile Regard to their Predecessors? The *Grecians* all, or the greatest Part of them, fetch'd their Learning from *Egypt*; and did they blindly assent to all that was taught them by the *Priests* of *Isis* and *Osiris*? If so; then why did they not, together with their Arts, receive all the infinite Idolatries, which their Masters embrac'd? Seeing it is not to be question'd, but the *Egyptians* deliver'd the Rites of their Religion to Strangers, with as much Solemnity at least, as they did the Mysteries of their *Hieroglyphicks*, or *Philosophy*. Now then, let *Pythagoras*, *Plato*, and *Aristotle*, and the rest of their wise Men, be our Examples, and we are safe. When they travell'd into the *East*, they collected what was fit for their Purpose, and suitable to the Genius of their Country, and left the Superfluities behind them: They brought home some

of their useful Secrets; but still counted their worshipping a Dog, or an Onion, a Cat, or a Crocodile, ridiculous. And why shall not we be allow'd the same Liberty, to distinguish, and choose what we will follow? Especially, seeing in this, they had a more certain Way of being instructed by their Teachers, than we have by them: They were present on the Place: They learn'd from the Men themselves, by word of Mouth, and so were in a likely Course to apprehend all their Precepts aright; whereas we are to take their Doctrines, so many hundred Years after their Death, from their Books only, where they are for the most part so obscurely express'd, that they are scarce sufficiently understood by the *Grammarians*; and *Linguists* themselves, much less by the *Philosophers*.

In few Words therefore, let such Men believe, that we have no Thought of detracting from what was good in former Times: But, on the contrary, we have a mind to bestow on them a solid Praise, instead of a great, and an empty. While we are raising new Observations upon Nature, we mean not to abolish the old, which were well and judiciously establish'd by them: No more, than a *King*, when he makes a new Coin of his own, does presently call in that, which bears the Image of his Father; he only intends thereby to increase the current Money of his Kingdom, and still permits the one to pass, as well as the other. It is probable enough, that upon a fresh Survey, we may find many Things true, which they have before asserted; and then will not they receive a greater Confirmation, from this our new and severe Approbation, than from those Men, who resign up their Opinions to their Words only? It is the best Way of honouring

houring them, to separate the certain Things in them, from the doubtful: For that shews, we are not so much carried towards them, by rash Affection, as by an unbiass'd Judgment. If we would do them the most Right, it is not necessary we should be perfectly like them in all Things. There are two principal Ways of preserving the Names of those that are past; the one, by *Pictures*; the other, by *Children*: The *Pictures* may be so made, that they may far nearer resemble the Original, than *Children* do their Parents; and yet all Mankind choose rather to keep themselves alive by Children, than by the other. It is best for the *Philosophers* of this Age to imitate the *Antients* as their *Children*; to have their Blood derived down to them; but to add a new Complexion, and Life of their own: While those, that endeavour to come near them in every Line, and Feature, may rather be called their dead *Pictures* or *Statues*, than their *genuine Off-spring*.

The End of the FIRST PART.

THE
HISTORY
OF THE
ROYAL SOCIETY.

The SECOND PART.

Sect. I.
*The Division
of the Narra-
tion.*



HUS I am, at length, arrived at the second Part of my Method, the *Narration* itself. This I shall divide into three Periods of Time, according to the several Degrees of the *Preparation, Growth, and complete Constitution* of the *Royal Society*.

The first shall consist of the *first Occasions* of this Model, and the Men, who first devised to put it in Execution; and shall end where they began to make it a formed and *regular Assembly*.

The second shall trace out their *first Attempts*, till they receiv'd the public Assistance of *Royal Authority*.

The third shall deliver what they *have done* since they were made a *Royal Corporation*.

It may seem perhaps, that in passing through the first of these, I go too far back, and treat of Things, that may appear to be of too private and domestic Concernment, to be spoken in this publick Way. But if this *Enterprize*, which is now so well established, shall be hereafter advantageous to Mankind (as I make no scruple to foretel that it will)

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it is but just, that future Times should hear the *Names* of its first *Promoters*: That they may be able to render particular Thanks to them, who first conceived it in their Minds, and practis'd some little Draught of it long ago. And besides, I never yet saw an Historian that was clear from all Affections; that, it may be, were not so much to be called *Integrity*, as a stoical *Insensibility*: Nor can I, more than others, resist my Inclinations, which strongly force me to mention that, which will be for the Honour of that Place, where I received a great Part of my Education. It was therefore some Space after the End of the Civil Wars at *Oxford*, in Doctor *Wilkins* his Lodgings, in *Wadham College*, which was then the Place of Resort for virtuous and learned Men, that the first Meetings were made, which laid the Foundation of all this that followed. The *University* had at that time many Members of its own, who had begun a *free way* of Reasoning; and was also frequented by some *Gentlemen* of Philosophical Minds, whom the Misfortunes of the Kingdom, and the Security and Ease of a Retirement amongst Gown-men, had drawn thither.

Their first Purpose was no more than only the Satisfaction of breathing a freer Air, and of conversing in Quiet one with another, without being engag'd in the Passions and Madness of that dismal Age. And from the Institution of that *Assembly*, it had been enough if no other Advantage had come but this: That by this means there was a Race of young Men provided against the next Age, whose Minds receiving from them their first Impressions of *sober* and *generous Knowledge*, were invincibly arm'd against all the Enchantments of *Enthusiasm*. But what is more, I may

Sect. II.
The Meetings at Oxford.

The HISTORY of

venture to affirm, that it was in good Measure by the Influence which these Gentlemen had over the rest, that the *University* itself, or at least, any Part of its Discipline and Order, was saved from Ruin. And from hence we may conclude, that the same Men have now no Intention of sweeping away all the Honour of Antiquity in this their new Design; seeing they employed so much of their Labour and Prudence in preserving that *most venerable Seat* of ancient Learning, when their shrinking from its Defence would have been the speediest Way to have destroyed it. For the Truth of this, I dare appeal to all uninterested Men, who knew the Temper of that Place; and especially to those who were my own Cotemporaries there; of whom I can name very many, whom the happy Restoration of the Kingdom's Peace found as well inclined to serve their *Prince* and the *Church*, as if they had been bred up in the most prosperous Condition of their Country. This was undoubtedly so: Nor indeed could it be otherwise; for such *spiritual Frensies*, which did then bear Rule, can never stand long, before a clear and a *deep Skill* in *Nature*. It is almost impossible, that they, who converse much with the Subtilty of *Things*, should be deluded by such *thick Deceits*. There is but one better Charm in the World, than *real Philosophy*, to allay the Impulses of the *false Spirit*; and that is, the blessed Presence and Assistance of the *true*.

Nor were the good Effects of this Conversation only confined to *Oxford*: But they have made themselves known in their printed Works, both in our own, and in the learned Language, which have much conduc'd to the Fame of our Nation *abroad*, and to the spreading of profitable Light *at home*. This, I trust,

trust, will be universally acknowledg'd, when I shall have nam'd the Men. The principal and most constant of them were Doctor *Seth Ward*, then Lord Bishop of *Exeter*, Mr. *Boyle*, Dr. *Wilkins*, Sir *William Petty*, Mr. *Matthew Wren*, Dr. *Wallis*, Dr. *Goddard*, Dr. *Willis*, Dr. *Bathurst*, Dr. *Christopher Wren*, Mr. *Rook*, besides several others who join'd themselves to them, upon Occasions. Now I have produc'd their Names, I am a little at a stand how to deal with them. For, if I should say what they deserve; I fear it would be interpreted Flattery, instead of Justice: And yet I have now lying in my Sight, the Example of an *Elegant Book*, which I have profess'd to admire, whose Author sticks not to make large Panegyricks on the Members of that *Assembly*, whose *Relation* he writes. But this Precedent is not to be follow'd by a *young Man*, who ought to be more jealous of publick Censure, and is not enough confirm'd in the good Liking of the World, to think, that he has such a weighty and difficult Work, as the making of Characters, committed to him. I will therefore pass by their Praises in Silence; though I believe, that what I might say of them, would be generally confess'd; and that if any ingenuous Man, who knows them, or their Writings, should contradict me, he would also go near to gainsay himself, and to retract the Applauses, which he had some Time or other bestow'd upon them.

For such a candid and unpassionate Company, as that was, and for such a gloomy Season, what could have been a fitter Subject to pitch upon than *Natural Philosophy*? To have been always tossing about some *Theological Question*, would have been, to have made that their private Diversion, the Excess of which

which they themselves dislik'd in the publick : To have been eternally musing on *Civil Business*, and the Distresses of their Country, was too melancholy a Reflexion : It was *Nature* alone, which could pleasantly entertain them in that Estate. The Contemplation of that, draws our Minds off from past, or present Misfortunes, and makes them Conquerors over Things, in the greatest publick Unhappiness : while the Consideration of *Men*, and *human Affairs*, may affect us with a thousand various Disquiets ; that never separates us into moral Factions ; that gives us room to differ, without Animosity ; and permits us to raise contrary Imaginations upon it, without any Danger of a *Civil War*.

Their *Meetings* were as frequent, as their Affairs permitted : their Proceedings rather by Action, than Discourse ; chiefly attending some particular Trials, in *Chymistry* or *Mechanicks* : they had no Rules nor Method fix'd : their Intention was more to communicate to each other their Discoveries, which they could make in so narrow a Compass, than an united, constant, or regular Inquisition. And methinks, their Constitution did bear some resemblance to the *Academy* lately begun at *Paris* : where they have at last turn'd their Thoughts from *Words* to experimental *Philosophy*, and perhaps in Imitation of the *Royal Society*. Their Manner likewise, is to assemble in a private House, to reason freely upon the Works of Nature, to pass Conjectures, and propose Problems, on any Mathematical, or Philosophical Matter, which comes in their Way. And this is an Omen, on which I will build some Hope, that as they agree with us in what was done at *Oxford*, so they will go on farther, and come by the same Degrees, to erect another

another *Royal Society* in *France*. I promise for these Gentlemen here (so well I know the Generosity of their Design) they will be most ready to accept their Assistance. To them, and to all the Learned World besides, they call for Aid. No difference of *Country*, *Interest*, or Profession of *Religion*, will make them backward from taking or affording Help in this Enterprize. And indeed all *Europe*, at this time, have two general Wars, which they ought in Honour to make; the one a *holy*, the other a *philosophical*: The one against the common Enemy of *Christendom*, the other also against powerful and barbarous Foes, that have not been fully subdued almost these six thousand Years, *Ignorance*, and *false Opinions*. Against these, it becomes us, to go forth in one common Expedition: All civil Nations joining their *Armies* against the one, and their *Reason* against the other; without any petty Contentions about Privileges, or Prudence.

Thus they continued without any great Intermissions, till about the Year 1638. But then being call'd away to several Parts of the Nation, and the greatest Number of them coming to *London*, they usually met at *Gresham College*, at the *Wednesday's*, and *Thursday's* Lectures of *Dr. Wren*, and *Mr. Rook*; where there join'd with them several eminent Persons of their common Acquaintance: The Lord *Viscount Brouncker*, the now Lord *Brereton*, *Sir Paul Neil*, *Mr. John Evelyn*, *Mr. Henshaw*, *Mr. Slingsby*, *Dr. Timothy Clarke*, *Dr. Ent*, *Mr. Ball*, *Mr. Hill*, *Dr. Crone*, and diverse other Gentlemen, whose Inclinations lay the same way. This Custom was observ'd once, if not twice a week, in Term-time, till they were scatter'd

Sect. III.
Their first
Meetings at
London.

ter'd by the the miserable Distractions of that fatal Year; till the Continuance of their Meetings there might have made them run the Hazard of the Fate of *Archimedes*: For then the place of their Meeting was made a *Quarter* for *Soldiers*. But, to make haste through those dreadful Revolutions, which cannot be beheld upon Paper without Horror, unless we remember, that they had this one happy Effect, to open Men's Eyes to look out for the true Remedy; upon this follow'd the *King's* Return; and that wrought by such an admirable Chain of Events, that if we either regard the *Easiness*, or *Speed*, or *blessed Issue* of the Work, it seems of itself to contain Variety and Pleasure enough, to make Recompence for the whole twenty Years Melancholy that had gone before. This I leave to another kind of History to be describ'd. It shall suffice my purpose, that Philosophy had its Share in the Benefits of that glorious Action: For the *Royal Society* had its beginning in the wonderful pacifick Year, 1660. So that if any Conjectures of good Fortune, from extraordinary *Nativities*, hold true, we may presage all Happiness to this Undertaking. And I shall here join my solemn Wishes, that as it began in that Time, when our Country was freed from Confusion and Slavery; so it may, in its Progress, redeem the Minds of Men from Obscurity, Uncertainty, and Bondage.

Sect. IV.
The Beginning of the
Royal Society.

These Gentlemen therefore finding the Hearts of their Countrymen enlarg'd by their Joys, and fitted for any noble Proposition; and meeting with the Concurrence of many worthy Men, who, to their immortal Honour, had follow'd the King in his Banishment, Mr. *Erskin*, Sir *Robert Moray*, Sir *Gilbert Talbot*,

bot, &c. began now to imagine some greater Thing, and to bring out experimental Knowledge from the *Retreats*, in which it had long hid itself, to take its Part in the *Triumphs* of that universal Jubilee. And indeed Philosophy did very well deserve that Reward, having been always Loyal in the worst of Times: For though the King's Enemies had gain'd all other Advantages; though they had all the Garrisons, and Fleets, and Ammunitions, and Treasures, and Armies on their side; yet they could never, by all their Victories, bring over the Reason of Men to their Party.

While they were thus ordering their Platform, there came forth a Treatise, which very much hasten'd its Contrivance; and that was a Proposal by Master *Cowley*, of erecting a Philosophical College. The Intent of it was, that in some places near *London*, there should liberal Salaries be bestowed on a competent Number of Learned Men, to whom should be committed the Operations of Natural Experiments. This Model was every way practicable; unless perhaps, in two Things, he did more consult the Generosity of his own Mind, than of other Men's: the one was the *Largeness of the Revenue*, with which he would have his College at first indowed; the other, that he impos'd on his Operators a second Task of great Pains, the *Education of Youth*.

The last of these is indeed a matter of great Weight; the Reformation of which ought to be seriously examined by prudent Men. For it is an undeniable Truth, which is commonly said, that there would be Need of fewer Laws, and less Force to govern Men, if their Minds were rightly inform'd, and set strait, while they were young, and pliable. But

perhaps this Labour is not so proper for Experimenters to undergo; for it would not only devour too much of their Time, but it would go near to make them a little more *magisterial* in Philosophy, than became them; by being long accustomed to command the Opinions, and direct the Manners, of their Scholars. And as to the other Particular, the large Estate which he required to the Maintenance of his College; it is evident, that it is so difficult a Thing to draw Men in to be willing to divert an antient Revenue, which has long run in another Stream, or to contribute out of their own Purse, to the supporting of any new Design, while it shews nothing but Promises, and Hopes; that, in such cases, it were (it may be) more advisable to begin upon a small Stock, and so to rise by degrees, than to profess great Things at first, and to exact too much Benevolence all in one Lump together. However, it was not the excellent Author's Fault, that he thought better of the Age than it did deserve. His Purpose in it was like himself, full of Honour and Goodness: Most of the other Particulars of his Draught the *Royal Society* is now putting in Practice.

I come now to the second Period of my Narration; wherein I promised to give an Account of what they did, till they were publickly owned, encouraged, and confirmed by Royal Favour. And I trust, that I shall here produce many Things, which will prove their Attempts to be worthy of all Men's Encouragement: though what was performed in this Interval may be rather styl'd the *Temporary Scaffold* about the Building, than the *Frame itself*. But in my Entrance upon this Part, being come to the Top of the Hill, I begin to tremble, and to apprehend the Greatness of my

my Subject. For I perceive, that I have led my Readers Minds on, by so long and so confident a Speech, to expect some wonderful Model, which shall far exceed all the former, that I have acknowledged to have been imperfect. Now, though this were really so, as I believe it is; yet I question, how it will look, after it has been disfigured by my unskilful Hands. But the Danger of this ought to have deterred me in the Beginning: It is now too late to look back; and I can only apply my self to that *good Nature*, which a *great Man* has observed to be so peculiar to our *Nation*, that there is scarce an Expression to signify it, in any other Language. To this I must fly for Succour, and most affectionately intreat my Countrymen, that they would interpret my Failings to be only Errors of Obedience to some, whose Commands, or Desires, I could not resist; and that they would take the Measure of the *Royal Society*, not so much from my lame Description of it, as from the Honour and Reputation of many of those Men, of whom it is composed.

I will here, in the first place, contract into few Words, the whole *Sum* of their *Resolutions*; which I shall often have occasion to touch upon in *Par-*
cels. Their Purpose is, in short, to make faithful *Re-*
records of all the Works of *Nature*, or *Art*, which can come within their Reach; that so the present Age, and Posterity, may be able to put a Mark on the Errors, which have been strengthened by long Prescription; to restore the Truths, that have lain neglected; to push on those, which are already known, to more various Uses; and to make the way more passable, to what remains unrevealed. This is the Compass of their
 Design.

Sect. V.
*A Model of
 their whole
 Design.*

Design. And to accomplish this, they have endeavoured, to separate the Knowledge of *Nature*, from the Colours of *Rhetorick*, the Devices of *Fancy*, or the delightful Deceit of *Fables*. They have labour'd to enlarge it, from being confined to the Custody of a few, or from Servitude to private Interests. They have striven to preserve it from being over-press'd by a confus'd Heap of vain and uselefs Particulars; or from being streightned and bound too much up by general Doctrines. They have tried to put it into a Condition of perpetual Increasing; by settling an inviolable Correspondence between the Hand and the Brain. They have studied to make it not only an Enterprize of one Season, or of some lucky Opportunity; but a Business of Time; a steady, a lasting, a popular, an uninterrupted Work. They have attempted, to free it from the Artifice, and Humours, and Passions of Sects: to render it an Instrument, whereby Mankind may obtain a Dominion over *Things*, and not only over one another's *Judgments*: And lastly, they have begun to establish these Reformatations in Philosophy, not so much, by any solemnity of Laws, or Ostentation of Ceremonies, as by solid Practice and Examples; not by a glorious Pomp of Words; but by the silent, effectual, and unanswerable Arguments of real Productions.

This will more fully appear, by what I am to say on these four Particulars, which shall make up this Part of my Relation, the *Qualifications* of their *Members*; the *Manner* of their *Inquiry*; their *Weekly Assemblies*; and their *Way of Registring*.

Sect. VI.
The Qualifications of the Members of the Royal Society.

As for what belongs to the *Members* themselves that are to constitute the *Society*: It is to be noted, that

that they have freely admitted Men of different Religions, Countries, and Professions of Life. This they were obliged to do, or else they would come far short of the Largeness of their own Declarations. For they openly profess, not to lay the Foundation of an *English, Scotch, Irish, Popish, or Protestant* Philosophy; but a Philosophy of *Mankind*.

That the *Church of England* ought not to be apprehensive of this free Converse of various Judgments, I shall afterwards manifest at large. For the present, I shall frankly assert, that our *Doctrine*, and *Discipline*, will be so far from receiving Damage by it; that it were the best Way to make them universally embrac'd, if they were oftner brought to be canvass'd amidst all Sorts of Dissenters. It is dishonourable, to pass a hard Censure on the Religions of all other Countries: It concerns them, to look to the Reasonableness of their Faith; and it is sufficient for us, to be established in the Truth of our own. But yet this Comparison I may modestly make; that there is no one Profession, amidst the several Denominations of Christians, that can be exposed to the Search and Scrutiny of its Adversaries, with so much safety as ours. So equal it is, above all others, to the general Reason of Mankind; such honourable Security it provides, both for the Liberty of Men's Minds, and for the Peace of Government; that if some Men's Conceptions were put in Practice, that all wise Men should have two Religions; the one, a *publick*, for their Conformity with the People, the other, a *private*, to be kept to their own Breasts; I am confident, that most considering Men, whatever their first were, would make ours their second, if they were well acquainted with it. Seeing therefore our Church would be in

They admit Men of all Religions.
so

so fair a Probability of gaining very much, by a frequent Contention and Encounter with other Sects : It cannot be indangered by this Assembly ; which proceeds no farther, than to an unprejudiced Mixture with them.

Of all Countries.

By their *naturalizing* Men of all Countries, they have laid the Beginnings of many great Advantages for the future. For by this Means, they will be able, to settle a *constant Intelligence*, throughout all civil Nations, and make the *Royal Society* the general *Bank* and Free-port of the World : A Policy, which whether it would hold good in the *Trade* of *England*, I know not ; but sure it will in the *Philosophy*. We are to overcome the Mysteries of all the Works of Nature ; and not only to prosecute such as are confin'd to one Kingdom, or beat upon one Shore : We should then refuse to list all the Aids, that will come in, how remote soever. If I could fetch my Materials whence I pleas'd, to fashion the *Idea* of a perfect Philosopher ; he should not be all of one *Clime*, but have the different Excellencies of several Countries. First, he should have the *Industry*, *Activity*, and *inquisitive Humor* of the *Dutch*, *French*, *Scotch*, and *English*, in laying the ground Work, the Heap of Experiments : And then he should have added the cold, and *circumspect*, and *wary* Disposition of the *Italians* and *Spaniards*, in meditating upon them, before he fully brings them into Speculation. All this is scarce ever to be found in one single Man ; seldom in the same Countrymen : It must then be supplied, as well as it may, by a *publick Council*, wherein the various Dispositions of all these Nations may be blended together. To this purpose, the *Royal Society* has made no Scruple to receive all inquisitive Strangers

Strangers of all Countries into its Number. And this they have constantly done, with such peculiar Respect, that they have not oblig'd them to the Charge of Contributions; they have always taken Care, that some of their Members should assist them in interpreting all that pass'd, in their publick Assemblies; and they have freely open'd their Registers to them; thereby inviting them to communicate foreign Rarities, by imparting their own Discoveries. This has been often acknowledg'd by many learned Men, who have travel'd hither; who have been introduc'd to their Meetings, and have admir'd the Decency, the Gravity, the Plainness, and the Calmness of their Debates. This they have publish'd to the World; and this has rous'd all our Neighbours to fix their Eyes upon *England*. From hence they expect the great Improvements of Knowledge will flow; and though, perhaps, they send their *Youth* into other Parts to learn *Fashion*, and *Breeding*; yet their *Men* come hither for nobler Ends, to be instructed in the *Masculine*, and the *solid Arts of Life*; which is a Matter of as much greater Reputation, as it is more honourable to teach Philosophers, than Children.

By their Admission of Men of all *Professions*, these *Of all Professions.*
two Benefits arise: The *one*, that every *Art*, and every Way of Life already establish'd, may be secure of receiving no Damage by their Counsels. A Thing which all new Inventions ought carefully to consult. It is in vain to declare against the Profit of the most, in any Change that we would make. We must not always deal with the violent Current of popular Passions, as they do with the furious *Eager* in the *Severn*; where the safest Way is to set the Head of the Boat directly against its Force. But here Men must

follow the Shore; wind about leisurably; and insinuate their useful Alterations by soft and unperceivable Degrees. From the Neglect of this Prudence, we often see Men of great Wit, to have been overborn by the Multitude of their Opposers; and to have found all their subtil Projects too weak for Custom and Interest: While being a little too much heated with a Love of their own Fancies, they have raised to themselves more Enemies than they needed to have done, by defying at once too many Things in Use. But here this Danger is very well prevented. For what Suspicion can *Divinity*, *Law*, or *Physick*, or any other Course of Life have, that they shall be impair'd by these Men's Labours; when they themselves are as capable of sitting amongst them as any others? Have they not the same Security that the whole Nation has for its Lives and Fortunes? Of which this is esteemed the Establishment, that Men of all Sorts and Qualities, give their Voice in every Law that is made in *Parliament*. But the other Benefit is, that by this equal Balance of all Professions, there will no one Particular of them overweigh the other, or make the *Oracle* only speak their *private* Sense; which else it were impossible to avoid. It is natural to all Ranks of Men, to have some one Darling, upon which their Care is chiefly fixed. If *Mechanicks* alone were to make a Philosophy, they would bring it all into their Shops, and force it wholly to consist of Springs, and Wheels, and Weights; if *Physicians*, they would not depart far from their Art; scarce any Thing would be considered, besides the *Body of Man*, the *Causes*, *Signs*, and *Cures* of Diseases. So much is to be found in Men of all Conditions, of that which is called *Pedantry* in Scholars; which is no-
thing

thing else but an obstinate Addition to the Forms of some private Life, and not regarding general Things enough. This Freedom therefore, which they use, in Embracing all Assistance, is most advantageous to them; which is the more remarkable, in that they diligently search out and join to them, all extraordinary Men, though but of ordinary Trades. And that they are likely to continue this comprehensive Temper hereafter, I will shew by one instance; and it is the Recommendation which the *King* himself was pleased to make, of the judicious Author of *the Observations on the Bills of Mortality*: In whose Election, it was so far from being a Prejudice, that he was a Shop-keeper of *London*; that his Majesty gave this particular Charge to his Society, that if they found any more such Tradesmen, they should be sure to admit them all, without any more ado. From hence it may be concluded, what is their Inclination towards the manual Arts; by the careful Regard which their *Founder* and *Patron*, has engag'd them to have for all Sorts of *Mechanick Artists*.

But, though the *Society* entertains very many Men of *particular Professions*, yet the far greater Number are *Gentlemen*, free and unconfin'd. By the Help of this there was hopeful Provision made against *two Corruptions* of Learning, which have been long complain'd of, but never remov'd: The one, that *Knowledge* still degenerates to consult *present Profit* too soon; the other, that *Philosophers* have been always *Masters* and *Scholars*; some imposing, and all the other submitting; and not as equal Observers without Dependence.

Sect. VII.
It consists chiefly of Gentlemen.

The first of these may be call'd, the *marrying of Arts* too soon; and putting them to Generation before they come to be of Age; and has been the Cause of

The Advantages of this.

much Inconvenience. It weakens their Strength ; it makes an unhappy Disproportion in their Increase ; while not the *best*, but the *most gainful* of them flourish : But above all, it diminishes that very Profit for which Men strive. It busies them about possessing some petty Prize ; while Nature itself, with all its mighty Treasures, slips from them ; and so they are serv'd like some foolish Guards ; who, while they were earnest in picking up some small Money, that the Prisoner drop'd out of his Pocket, let the Prisoner himself escape, from whom they might have got a great Ransom. This is easily declaim'd against, but most difficult to be hindred. If any Caution will serve, it must be this ; to commit the Work to the Care of such Men, who, by the Freedom of their Education, the Plenty of their Estates, and the usual Generosity, of noble Blood, may be well suppos'd to be most averse from such sordid Considerations.

The second Error, which is hereby endeavour'd to be remedied, is, that the Seats of Knowledge have been for the most part heretofore, not *Laboratories*, as they ought to be ; but only *Schools*, where some have *taught*, and all the rest *subscrib'd*. The Consequences of this are very mischievous. For first, as many *Learners* as there are, so many Hands and Brains may still be reckon'd upon as useless. It being only the *Master's* part to examine, and observe ; and the Disciples, to submit with Silence to what they conclude. But besides this, the very Inequality of the Titles of *Teachers* and *Scholars*, does very much suppress and tame Men's Spirits ; which though it should be proper for Discipline and Education ; yet is by no means consistent with a free philosophical Consultation. It is undoubtedly true ; that scarce any Man's

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Mind,

Mind is so capable of *thinking strongly*, in the Presence of one whom he *fears* and *reverences*, as he is when that Restraint is taken off. And this is to be found, not only in these weightier Matters; but also to give a lighter instance in the Arts of *Discourse* and *Railery* themselves. For we have often seen Men of bold Tempers, that have over-aw'd and govern'd the Wit of most Companies; to have been disturb'd, and dumb, and bashful as Children; when some other Man has been near, who us'd to out-talk them. Such a kind of natural Sovereignty there is in some Men's Minds over others; which must needs be far greater, when it is advanc'd by long Use, and the *venerable Name* of a *Master*. I shall only mention one *Prejudice* more, and that is this; that from this only Teaching, and Learning, there does not only follow a Continuance, but an Increase of the Yoak upon our Reasons: For those who take their Opinions from others Rules, are commonly stricter Imposers upon their Scholars, than their own Authors were on them, or than the first Inventors of Things themselves are upon others. Whatever the Cause of this be: whether the first Men are made meek and gentle by their long Search, and by better understanding all the Difficulties of Knowledge; while those that learn afterwards, only hastily catching Things in small *Systems*, are soon satisfy'd, before they have broken their Pride, and so become more imperious; or whether it arises from hence, that the same *Meanness of Soul*, which made them bound their Thoughts by other Precepts, makes them also *insolent* to their Inferiors; as we always find *Cowards* the most *cruel*; or whatever other Cause may be alledg'd, the Observation is certain, that the *Successors* are usually more positive and tyrannical, than the *Beginners* of Sects. It

If then there can be any Cure devis'd for this, it must be no other than to form an *Assembly* at one Time, whose Privileges shall be the same; whose Gain shall be in common; whose *Members* were not brought up at the Feet of each other. But after all, even this cannot be free from Prevarication in all future Ages. So apt are some to distrust, and others to confide too much in themselves; so much Sweetness there is, in leading Parties; so much Pride in following a Faction; such various Artifices there are to ensnare Men's *Passions*, and soon after their *Understandings*. All these Hazards, and many more, are to be suppos'd; which it is impossible for mortal Wit wholly to foresee, much less to avoid. But yet we have less Ground of Jealousy from this Institution than any other, not only because they only deal in Matters of *Fact*, which are not so easily perverted; but also upon Security of the Inclinations of the greatest Part of the *Members* of the *Society* itself. This, I hope, most Men will acknowledge; and I will take the Permission to say in general of them, that in all *past* and *present* Times, I am confident there can never be shewn so great a Number of *Cotemporaries* in so narrow a Space of the World, that lov'd Truth so zealously sought it so constantly; and upon whose Labours Mankind might so freely rely. This I speak, not out of Bravery to *Foreigners* (before whose Eyes, I believe, this negligent Discourse will never appear) but to the learned Men of this *Nation*, who are better Judges of what I say. And this too, I dare affirm, in an *Age*, wherein I expect to be condemn'd of Falshood or Partiality for this Character, which I have given. For so it happens, that we are now arriv'd at that excessive censuring Humour, that he who takes upon him to commend any thing,

thing, though ever so worthy, will raise to himself far more Enemies than Friends. And indeed this *Sourness* of *Criticism*, which now bears down all before it, is very injurious to the Honour of our Country. For by despising Men for not being absolutely excellent, we keep them from being so; while *Admonitions* joined with *Praises*, and *Reproofs* with *Directions*, would quickly bring all Things to a higher Perfection. But the Rudeness of such *Criticks* I do not so much regard, as the Objections of soberer Men, who have a real good Will to the Promotion of this Design, and yet may be a little dissatisfied in this Place. For here especially they may doubt of two Things; the first, whether the *Royal Society* being so numerous as it is, will not in short Time be diverted from its primitive Purpose; seeing there will be scarce enough Men of philosophical Temper always found to fill it up; and then others will crowd in, who have not the same Bent of Mind; and so the whole Business will insensibly be made rather a Matter of Noise and Pomp, than of real Benefit! The second, whether their Number being so large, will not affright private Men from imparting many profitable Secrets to them; lest they should thereby become common, and so they be deprived of the Gain, which else they might be sure of, if they kept them to themselves.

To the first I shall reply, That this Scruple is of no Force, in respect of *the Age wherein we live*. For now the Genius of *Experimenting* is so much dispers'd, that even in this *Nation*, if there were one or two more such *Assemblies* settled, there could not be wanting able Men enough to carry them on. All Places and Corners are now busy and warm about this Work :
and

Sect. VIII.
*A Defence of
the Largeness of their
Number.*

and we find many noble Rarities to be every Day given in not only by the Hands of learned and professed Philosophers; but from the Shops of *Mechanicks*; from the Voyages of *Merchants*; from the Ploughs of *Husbandmen*; from the Sports, the Fishponds, the Parks, the Gardens of *Gentlemen*; the Doubt therefore will only touch *future Ages*. And even for them too, we may securely promise, that they will not, for a long Time, be barren of a Race of inquisitive Minds, when the Way is now so plainly trac'd out before them; when they should have tasted of these first Fruits, and have been excited by this Example. There was scarce ever yet, any the meanest Sect, or the most contemptible Opinion, that was utterly extinguish'd in its Cradle. Whether they deserv'd to live, or not, they all had their Course; some longer, some shorter, according as they could combine with the Interests or Affections of the Countries where they began. What Reason then have we to bode ill alone to this *Institution*, which is now so earnestly embraced; and which, the older it grows, cannot but still appear more inoffensive? If we only required *perfect Philosophers* to manage this Employment, it were another Case. For then I grant it were improbable, that threescore, or an hundred such should meet in one Time. But here it is far otherwise; if we cannot have a sufficient Choice of those that are skill'd in all *Divine* and *Human* Things (which was the ancient Definition of a Philosopher) it suffices, if many of them be plain, diligent, and laborious Observers: such, who though they bring not much Knowledge, yet bring their Hand, and their Eyes uncorrupted: such as have not their Brains infected by false Images, and can honestly assist in the *examining* and *registering* what

what the others represent to their View. It seems strange to me, that Men should conspire to believe all things more perplexed, and difficult, than indeed they are. This may be shewn in most other Matters; but in this particular in hand, it is most evident, Men did generally think, that no Man was fit to meddle in Matters of this Consequence, but he that had bred himself up in a long Course of Discipline for that Purpose; that had the Habit, the Gesture, the Look of a Philosopher: Whereas Experience, on the contrary, tells us, that greater Things are produc'd by the *free* way, than the *formal*. This Mistake may well be compar'd to the Conceit we had of *Soldiers*, in the beginning of the civil Wars. None was thought worthy of that Name; but he that could shew his Wounds, and talk aloud of his Exploits in the *Low Countries*: Whereas the whole Business of fighting, was afterwards chiefly perform'd by *untravel'd Gentlemen, raw Citizens*, and *Generals* that had scarce ever before seen a Battle. But to say no more, it is so far from being a Blemish, that it is rather the Excellency of this Institution, that *Men of various Studies* are introduced. For so there will be always many sincere Witnesses standing by, whom Self-love will not persuade to report falsely, nor Heat of Invention carry to swallow a Deceit too soon; as having themselves no Hand in the making of the Experiment, but only in the *Inspection*. So cautious ought Men to be, in pronouncing even upon Matters of Fact. The whole Care is not to be trusted to *single Men*; not to a *Company* all of *one Mind*; not to *Philosophers*; not to *devout* and religious Men *alone*: By all these we have been already deluded; even by those whom I last named, who ought most of all to abhor Falshood; of whom yet many have mul-

tiplied upon us infinite Stories and false Miracles, without any regard to Conscience or Truth.

To the second Objection I shall briefly answer; that if all the Authors, or Possessors of extraordinary Inventions, should conspire to conceal all that was in their Power from them; yet the *Method* which they take will quickly make abundant Reparation for that Defect. If they cannot come at Nature in its particular *Streams*, they will have it in the *Fountain*. If they could be shut out from the Closets of *Physicians*, or the Work-houses of *Mechanicks*; yet with the same, or with better Sorts of Instruments, on more Materials, by more Hands, with a more rational Light, they would not only restore again the old Arts, but find out perhaps many more of far greater Importance. But I need not lay much Stress upon that Hope; when there is no Question at all, but all, or the greatest part of such *domestick Receipts* and Curiosities, will soon flow into this *publick Treasury*. How few Secrets have there been, though ever so gainful, that have been long conceal'd from the whole World by their *Authors*? Were not all the least Arts of Life at first private? Were not *Watches*, or *Locks*, or *Guns*, or *Printing*, or lately the *Bow-dye*, devis'd by *particular Men*, but soon made *common*? If neither *Chance*, nor *Friendship*, nor *Treachery* of Servants, have brought such Things out; yet we see *Ostentation* alone to be every Day powerful enough to do it. This Desire of Glory, and to be counted *Authors*, prevails on all, even on many of the dark and reserv'd *Chymists* themselves; who are ever printing their greatest Mysteries, though indeed they seem to do it with so much Reluctancy, and with a Willingness to hide still; which makes their *Style* to resemble the *Smoke*, in which they deal.

deal. Well then, if this Disposition be so *universal*, why should we think, that the Inventors will be only tender and backward to the *Royal Society*; from which they will not only reap the most *solid Honour*, but will also receive the strongest Assurances of still retaining the *greatest part of the Profit*? But if all this should fail, there still remains a Refuge, which will put this whole Matter out of Dispute: and that is, that the *Royal Society* will be able by Degrees to purchase such extraordinary Inventions, which are now close lock'd up in *Cabinets*; and then to bring them into one common Stock, which shall be upon all occasions expos'd to all Men's Use. This is a most *heroick Intention*: For by such Concealments, there may come very much Hurt to Mankind. If any certain Remedy should be found out against an *Epidemical Disease*; if it were suffer'd to be ingross'd by one Man, there would be great Swarms swept away, which otherwise might be easily sav'd. I shall instance in the *Sweating-Sickness*. The *Medicine* for it was almost infallible: But, before that could be generally publish'd, it had almost dispeopled whole Towns. If the same Disease should have return'd, it might have been again as destructive, had not the Lord *Bacon* taken Care, to set down the particular Course of *Physick* for it, in his History of *Henry the Seventh*, and so put it beyond the Possibility of any private Man's invading it. This ought to be imitated in all other *sovereign Cures* of the like Nature, to avoid such dreadful Casualties. The *Artificers* should reap the common Crop of their *Arts*; but the *Publick* should still have *Title* to the miraculous Productions. It should be so appointed, as it is in the Profits of Men's Lands; where the Corn, and Grass, and Timber, and some coarser Metals belong to the

Owner: But the *Royal Mines*, in whose Ground soever they are discovered, are no Man's Propriety, but still fall to the *Crown*.

These therefore are the *Qualities* which they have principally required in those whom they admitted; still reserving to themselves a Power of *increasing*, or keeping to their Number, as they saw Occasion. By this means, they have given Assurance of an eternal Quietness and Moderation, in their experimental Progress; because they allow themselves to differ in the weightiest Matter, even in the *Way of Salvation* itself. By this they have taken Care, that nothing shall be so remote as to escape their Reach; because some of their *Members* are still scattered abroad, in most of the habitable Parts of the Earth. By this they have provided, that no profitable Thing shall seem too mean for their Consideration, seeing they have some amongst them, whose Life is employed about *little* Things, as well as *great*. By this they have broken down the Partition-wall, and made a fair Entrance, for *all Conditions of Men* to engage in these Studies: which were heretofore affrighted from them, by a groundless Apprehension of their Chargeableness and Difficulty. Thus they have formed that *Society*, which intends a *Philosophy*, for the Use of *Cities*, and not for the Retirements of *Schools*, to resemble the *Cities* themselves; which are compounded of all Sorts of Men, of the *Gown*, of the *Sword*, of the *Shop*, of the *Field*, of the *Court*, of the *Sea*; all mutually assisting each other.

Sect. IX. Let us next consider what *Course of Inquiry* they *Their Course* take, to make all their Labours unite for the Service *of Inquiry*. of Mankind: And here I shall insist on their *Expence*, their *Instruments*, their *Matter*, and their *Method*.

Of the Stock, upon which their *Expence* has been *Their Ex-*
hitherto defrayed, I can say nothing that is very *magni-*
ficient; seeing they have relied upon no more than
some small *Admission-money*, and *weekly Contribu-*
tions amongst themselves. Such a *Revenue* as this
can make no great Sound, nor amount to any *vast*
Sum. But yet I shall say this for it, that it was the
only way which could have been begun, with a *Secu-*
rity of Success, in that Condition of Things. The
publick Faith of experimental Philosophy, was not
then strong enough, to move Men and Women of
all Conditions, to bring in their Bracelets and Jewels,
towards the carrying of it on. Such Affections as those
may be raised by a misguided Zeal; but seldom, or
never, by calm and unpassionate Reason. It was
therefore well ordained, that the first Benevolence
should come from the *Experimenters themselves*. If
they had speedily at first called for *mighty Treasures*;
and said aloud, that their Enterprize required the *Ex-*
chequer of a Kingdom; they would only have been
contemn'd as vain *Projectors*. So ready is Man-
kind to suspect all new Undertakings to be Cheats,
and *Chimæras*; especially, when they seem *charge-*
able; that it may be, many excellent Things have been
lost by that Jealousy. Of this we have a fatal Instance
amongst our selves. For it was this fear of being cir-
cumvented, that made one of our wisest *Kings* de-
lay *Columbus* too long, when he came with the Pro-
mise of a *new World*; whereas a little more Confi-
dence in his *Art*, and a small Charge in furnishing out
some few Ships, would have yearly brought all the
Silver of the *West-Indies* to *London*, which now ar-
rives at *Sevil*.

This Suspicion, which is so natural to Men's Breasts,
could

could not any way harm the *Royal Society's* Establishment; seeing its first Claims and Pretensions were so modest. And yet I shall presume to assure the World; that what they shall raise on these mean Foundations, will be more answerable to the *Largeness* of their Intentions, than to the *Narrowness* of their Beginnings. This I speak so boldly, not only because it is almost generally found true; that those Things, which have been *small* at first, have oftner grown *greater*, than those which have begun upon a wider Bottom, which have commonly *stood at a Stay*: But also in respect of the present prevailing *Genius* of the *English* Nation. It is most usually found, that every People has some one Study or other in their View, about which their Minds are most intent, and their Purses readier to open. This is sometimes a Profusion in *Habit* and *Diet*; sometimes *religious Buildings*; and sometimes the *civil Ornaments* of their Cities and Country. The first of these will shortly vanish from amongst us, by the irresistible Correction of the King's own Example; the *next* is of late Years very sensibly abated: and it is the *last* of the three towards which Men's Desires are most propense. To evidence this; I think it may be calculated, that since the King's return, there have been more *Acts of Parliament*, for the *clearing* and *beautifying* of Streets, for the *repairing* of *Highways*, for the *cutting* of *Rivers*, for the *increase* of *Manufactures*, for the setting on foot the Trade of Fishing, and many other such publick Works, to adorn the State, than in diverse Ages before. This *general Temper* being well weigh'd, it cannot be imagined, that the *Nation* will withdraw its Assistance from the *Royal Society* alone; which does not intend to stop at some *particular Benefit*, but goes to the Root
of

of *all noble Inventions*, and proposes an infallible Course to make *England* the Glory of the Western World.

This my Love and my Hopes prompt me to say. But besides this, there is one Thing more, that persuades me, that the *Royal Society* will be *immortal*, and that is, that if their Stock should still continue narrow, yet even upon that, they will be able to free themselves from all Difficulties, and to make a constant Increase of it, by their managing. There is scarce any thing has more hindred *the true Philosophy*, than a vain Opinion, that Men have taken up, that Nothing could be done in it, to any purpose, but upon a *vast Charge*, and by a *mighty Revenue*. Men commonly think, that the *Pit*, in which (according to *Democritus*) Truth lyes hid, is bottomless; and that it will devour, whatever is thrown into it, without being the fuller. This false Conception had got so much Ground, that as soon as a Man began to put his Hands to *Experiments*, he was presently given over, as impoverished and undone. And indeed the Enemies of real Knowledge, had some Appearance of Reason to conclude this heretofore; because they had seen the great Estates of some *Chymists* melted away, without any Thing left behind, to make Recompence. But this Imagination can now no longer prevail: Men now understand, that Philosophy needs not so great a Prodigality to maintain it; that the most *profitable* Trials are not always the most *costly*; that the best Inventions have not been found out by the *richest*, but by the most *prudent* and *industrious* Observers; that the right *Art of Experimenting*, when it is once set forward, will go near to sustain itself. This I speak, not to stop Men's future Bounty, by a philosophical Boast,
that

that the *Royal Society* has enough already : But rather to encourage them to cast in more Help ; by shewing them, what Return may be made from a little, by a wise Administration.

Sect. X. Of the Variety and Excellence of the *Instruments*, which it lyes in their Power to use, I will give no other Proof, than the wonderful Perfection to which all manual Arts have of late Years arrived. Men now generally understand, to employ those very Tools which the *Antients* lent us, to infinite more Works than formerly ; they have also of late devis'd a great Multitude of all Sorts, which were before *unknown* ; and besides we may very well expect, that Time will every Day bring forth *more*. For according as the *Matter* to work upon does abound, the greater Plenty of *Instruments* must by Consequence follow ; such a Connexion there is between *Inventions*, and the *Means* of inventing, that they mutually increase each other.

I might be as large, as I pleas'd, in this Particular ; in running through some Part of all the innumerable Arts of the *western World* ; and it were not difficult to shew, that the ordinary Shops of *Mechanicks* are now as full of *Rarities*, as the *Cabinets* of the former *noblest Mathematicians*. But I will leave that Subject, which is so familiar to all, and choose rather to fetch a Confirmation of this, even from those Countries, which (after the Manner of the *Antients*) we call *barbarous*. And in going thither for an Example, I have a farther End. In my foregoing Discourse, I tried to make out the Advantages of the *modern Times* above the *antient* ; by following the Progress of Learning, down through their Tracts, to which *Scholars*

lars usually confine it; I will now also strengthen that Argument, by briefly comparing the Skill and the Works of the *unlearned* Parts of the *present* World with those that are *past*. The antient *Barbarians* then, those *Nations* I mean, who lay without the Circle of those Arts which we admire; the *Gauls*, the *Britains*, the *Germans*, the *Scythians*, have scarce left any Footsteps behind them, to shew that they were rational Men. Most of them were savage in their *Practices*; gross in their *Contrivances*; ignorant of all, that might make Life either safe, or pleasant. Thus it was with them, and this all History speaks with one Voice; whereas the *Barbarians* of our Times (if I may take the Liberty still to use that Word, which the Pride of *Greece* first brought into Fashion) the *Turks*, the *Moors*, the *East-Indians*, and even the *Americans*, though they too are utterly unacquainted with all our Sciences; yet by the Help of an *universal Light*, which seems to overspread this *Age*, are in several *Handicrafts* most ready, and dextrous; in so much that in some, they can scarce be imitated by the *Europeans* themselves. I shall leave it to any Man to conjecture from hence, which of these two Times has the prerogative; and how much better Helps are probably to be found at this Day, in the most *civil Countries*; when we now find so much Artifice, amongst those our *Cotemporaries*, who only follow *rude*, and *untaught* Nature.

Of the *Extent* of the *Matter*, about which they Sect. XI.
have been already conversant, and intend to be here-
after; there can be no better Measure taken, than by *Their Mat-*
giving a *general Prospect* of all the Objects of Men's *ter.*
Thoughts; which can be nothing else but either *God*,
or *Men*, or *Nature*.

As for the first, they meddle no otherwise with *divine Things*, than only as the *Power*, and *Wisdom*, and *Goodness* of the *Creator* is display'd in the admirable Order and Workmanship of the *Creatures*. It cannot be deny'd, but it lies in the *natural Philosopher's* Hands, best to advance that Part of *Divinity*; which, though it fills not the Mind with such *tender* and *powerful Contemplations*, as that which shews us Man's *Redemption* by a *Mediator*; yet it is by no means to be pass'd by unregarded, but is an excellent Ground to establish the other. This is a *Religion* which is confirm'd by the unanimous Agreement of all Sorts of *Worships*, and may serve in respect to *Christianity*, as *Solomon's* *Porch* to the *Temple*; into the one the *Heathens* themselves did also enter, but into the other, only God's *peculiar People*.

In Men, may be consider'd the *Faculties* and *Operations* of their *Souls*, the *Constitution* of their *Bodies*, and the *Works* of their *Hands*. Of these, the *first* they omit; both because the Knowledge and Direction of them have been before undertaken, by some *Arts*, on which they have no mind to intrench, as the *Politicks*, *Morality*, and *Oratory*; and also because the *Reason*, the *Understanding*, the *Temper*, the *Will*, the *Passions* of Men, are so hard to be reduc'd to any certain Observation of the *Senses*, and afford so much Room to the *Observers* to falsify or counterfeit; that if such Discourses should be once entertain'd, they would be in Danger of falling into *talking*, instead of *working*, which they carefully avoid. Such Subjects therefore as these they have hitherto kept out. But yet, when they shall have made more Progress in *material* Things, they will be in a Condition of pronouncing more boldly on them too. For though Man's *Soul*
and

and *Body* are not only one *natural Engine* (as some have thought) of whose Motions of all Sorts, there may be as certain an Account given, as of those of a Watch or Clock; yet by long studying of the *Spirits*, of the *Blood*, of the *Nourishment*, of the Parts, of the *Diseases*, of the *Advantages*, of the Accidents which belong to *human Bodies* (all which will come within their Province) there may, without Question, be very near Guesses made, even at the more *exalted* and *immediate* Actions of the *Soul*; and that too, without destroying its *spiritual* and *immortal* Being.

These two Subjects, *God*, and the *Soul*, being only forborn, in all the rest they wander at their Pleasure: In the Frame of *Men's Bodies*, the Ways for strong, healthful, and long Life; in the *Arts of Men's Hands*, those that either *Necessity*, *Convenience*, or *Delight* have produc'd; in the *Works of Nature*, their Helps, their Varieties, Redundancies, and Defects; and in bringing all these to the *Uses of human Society*.

In their *Method of inquiring*, I will observe how they have behav'd themselves in Things that might be brought within their *own Touch* and *Sight*; and how in those, which are so remote, and hard to be come by, that about them they were forc'd to trust the *Reports of others*. Sect. XII.
Their Method of Inquiry.

In the first Kind, I shall lay it down as their *fundamental Law*, that whenever they could possibly get to *handle* the Subject, the *Experiment* was still perform'd by some of the *Members* themselves. The want of this *Exactness* has very much diminish'd the Credit of former *Naturalists*; it might else have seem'd strange, that so many Men of Wit, setting so many Hands on work, being so watchful to catch up all Re-

lations, from Woods, Fields, Mountains, Rivers, Seas, and Lands; and scattering their Pensions so liberally; should yet be able to collect so few Observations, that have been judicious or useful. But the Reason is plain; for while they thought it enough, to be only *Receivers* of others Intelligence; they have either employ'd *ignorant* Searchers, who knew not how to digest or distinguish what they found; or *frivolous*, who always lov'd to come home laden, though it were but with Trifles; or (which is worst of all) *crafty*, who having perceiv'd the Humours of those that paid them so well, would always take care to bring in such Collections as might seem to agree with the Opinions and Principles of their *Masters*, however they did with *Nature* itself.

This Inconvenience the *Royal Society* has escap'd, by making the whole Process pass under its own Eyes. And the Task was divided amongst them, by one of these two Ways. First, it was sometimes referr'd to some *particular Men*, to make Choice of what *Subject* they pleas'd, and to follow their own Humour in the *Trial*; the *Expence* being still allow'd from the general Stock. By which Liberty, that they afforded, they had a very necessary regard to the Power of *particular Inclinations*; which in all Sorts of *Knowledge* is so strong; that there may be numberless Instances given of Men, who in some Things have been altogether *useless*, and yet in others have had such a vigorous and *successful* Faculty, as if they had been born and form'd for them alone.

Or else secondly, the *Society* itself made the Distribution, and deputed whom it thought fit for the Prosecution of such or such Experiments. And this they did, either by allotting the *same Work* to *several*

2

Men,

Men, separated from one another; or else by *joining* them into *Committees*, (if we may use that Word in a philosophical Sense, and so in some Measure purge it from the ill Sound which it formerly had.) By this *Union of Eyes and Hands* there do these *Advantages* arise. Thereby there will be a full *Comprehension* of the Object in *all* its Appearances; and so there will be a mutual Communication of the Light of one *Science* to another; whereas *single Labours* can be but as a Prospect taken upon one side. And also by this fixing of several Men's Thoughts upon one Thing, there will be an excellent Cure for that *Defect*, which is almost unavoidable in great *Inventors*. It is the Custom of such earnest and powerful Minds, to do wonderful Things in the *Beginning*; but shortly after, to be overborn by the Multitude and Weight of their own Thoughts; then to yield, and cool by little and little; and at last grow weary, and even to loath that, upon which they were at first the most eager. This is the wonted Constitution of *great Wits*; such tender things are those exalted Actions of the Mind; and so hard it is, for those Imaginations, that can run swift and mighty Races, to be able to travel a long and a constant Journey. The Effects of this Infirmary have been so remarkable, that we have certainly lost very many *Inventions*, after they have been in part fashion'd, by the meer *languishing* and *negligence* of their *Authors*. For this, the best Provision must be, to join many Men together; for it cannot be imagin'd, that they should be all so violent and fiery; and so by this mingling of Tempers, the *impetuous* Men not having the whole Burthen on them, may have Leisure for Intervals to recruit their first Heat; and the more *judicious*, who are not so soon possess'd with such Raptures, may carry on

on the others strong Conceptions, by soberer Degrees, to a full Accomplishment.

SECT. XIII.
*Their way of
 Inquiry into
 remote Mat-
 ters.*

This they have practis'd in such Things whereof the Matter is common, and wherein they may repeat their Labours as they please. But in *foreign* and *remote* Affairs, their *Intentions* and their *Advantages* do far exceed all others. For these they have begun to settle a *Correspondence* through all Countries; and have taken such Order, that in short Time there will scarce a Ship come up the *Thames*, that does not make some return of *Experiments*, as well as of *Merchandize*.

This their Care of an *universal Intelligence* is befriended by *Nature* itself, in the Situation of *England*: For, lying so as it does, in the Passage between the *Northern* Parts of the World and the *Southern*; its *Ports* being open to all Coasts, and its *Ships* spreading their *Sails* in all *Seas*; it is thereby *necessarily* made, not only *Mistress* of the *Ocean*, but the most proper *Seat* for the Advancement of *Knowledge*. From the *Positions* of Countries arise not only their several Shapes, Manners, Customs, Colours, but also their *different Arts* and *Studies*. The *Inland* and *Continent* we see do give Laws to Discourse, to Habits, to Behaviour; but those that border upon the *Seas*, are most properly seated to bring home Matter for *new Sciences*, and to make the same Proportion of Discoveries above others in the *intellectual* Globe, as they have done in the *Material*.

Upon this Advantage of our Island, there is so much Stress to be laid towards the Prosperity of this Design, that if we should search through all the World for a perpetual Habitation, wherein the universal Philosophy might settle itself, there can none be found,

which is comparable to *London*, of all the former, or present Seats of Empire. *Babylon*, that was the *Capital City* of the first *Monarchy*, was situated in a *Champion Country*, had a clear and uncloudy *Air*; and was therefore fit enough to promote one part of *natural Knowledge*, the *Observations* of the *Heavens*: But it was a *Mid-land Town*, and regarded not the *Traffick* of *Foreigners*, abounding with its own *Luxury* and *Riches*. *Memphis* was improper, upon the same account; for *Egypt* was a *Land content with its own Plenty*, admitting *Strangers*, rather to instruct them, than to learn any thing from them. *Carthage* stood not so well for a *Resort* for *Philosophers*, as for *Pirates*; as all the *African Shore* continues at this Day. As for *Rome*, its *Fortune* was read by *Virgil*; when he said, that *it only ought to excel in the Arts of Ruling*. *Constantinople*, though its present *Masters* were not *barbarous*, yet is too much shut up by the *Straits* of the *Hellespont*. *Vienna* is a *Frontier Town*, and has no *Communication* with the *Ocean*, but by a long *Compass* about. *Amsterdam* is a place of *Trade*, without the *Mixture* of *Men* of *freer Thoughts*. And, even *Paris* itself, though it is far to be preferr'd before all the others for the *Resort* of *learned* and *inquisitive Men* to it, yet is less capable, for the same *Reasons* for which *Athens* was, by being the *Seat* of *Gallantry*, the *Arts of Speech*, and *Education*. But it is *London* alone, that enjoys most of the other's *Advantages* without their *Inconveniences*. It is the *Head* of a *mighty Empire*, the greatest that ever commanded the *Ocean*: It is compos'd of *Gentlemen*, as well as *Traders*: It has a large *Inter-course* with all the *Earth*: It is, as the *Poets* describe their *House of Fame*, a *City*, where all the *Noises* and *Business* in the *World* do meet; and therefore this

Honour

Honour is justly due to it, to be the *constant* place of *Residence* for that *Knowledge*, which is to be made up of the Reports and Intelligence of all Countries.

To this I will add; That we have another Help in our Hands, which almost forces this Crown on the Head of the *English* Nation: and that is, the *noble* and *inquisitive* *Genius* of our *Merchants*. This cannot be better shewn, than by comparing them with those of that one Country, which only stands in Competition with us for Trade. The *Merchants* of *England* live honourably in foreign Parts; those of *Holland* meanly, minding their Gain alone: ours converse freely, and learn from all; having in their Behaviour very much of the *Gentility* of the Families, from which so many of them are descended: The others when they are abroad, shew, that they are only a Race of plain *Citizens*, keeping themselves most within their own Cells, and Ware-houses; scarce regarding the Acquaintance of any, but those with whom they traffick. This *Largeness* of ours, and *Narrowness* of their living, does, no doubt, conduce very much to enrich them; and is, perhaps, one of the Reasons that they can so easily under-sell us: But withal it makes ours the most *capable*, as theirs *unfit*, to promote such an *Enterprise*, as this of which I am now speaking. For indeed, the Effects of their several Ways of Life are as different: Of the *Hollanders*, I need say no more, but of the *English Merchants* I will affirm, that in all sorts of Politeness, and Skill in the *World* and *human Affairs*, they do not only excell them, but are equal to any other sort of Men amongst us.

This I have spoken, not to lessen the Reputation of that *industrious People*: But, that I might (if it were possible) inflame their Minds to an Emulation of this
Design:

Design. They have all things imaginable to stir them up; they have the Examples of the greatest *Wits* of other Countries, who have left their own Homes, to retire thither, for the Freedom of their Philosophical Studies: They have one Place (I mean the *Hague*) which may be soon made the very Copy of a Town in the *New Atlantis*; which for its Pleasantness, and for the Concourse of Men of all Conditions to it, may be counted, above all others, (except *London*) the most advantageously seated for this Service.

These have been the Privileges and Practices of the *Royal Society*, in Things foreign and native. It would now be needless to set down all the Steps of their Progress about them; how they observ'd all the Varieties of *Generations* and *Corruptions*, natural and artificial; all the Increasings and Lessenings, Agreements and Oppositions of Things; how, having found out a *Cause*, they have applied it to many other *Effects*, and the *Effects* to different *Causes*; how they are wont to change the Instruments, and Places, and Quantities of Matter, according to Occasions: and all the other Subtilties and Windings of Trial, which are almost infinite to express. I shall only, in passing, touch on these two Things, which they have most carefully consulted.

The one is, not to prescribe to themselves any certain *Art* of *Experimenting*, within which to circumscribe their Thoughts; but rather to keep themselves free, and change their Course, according to the different Circumstances that occur to them in their Operations, and the several Alterations of the Bodies on which they work. The true *Experimenting* has this one thing inseparable from it, never to be a *fixed* and *settled Art*, and never to be *limited* by constant Rules. This, perhaps, may be shewn too in other *Arts*; as in

that of Invention, of which, though in *Logick* and *Rhetorick* so many Bounds and Helps are given, yet I believe very few have argued or discoursed by those *Topicks*. But whether that be unconfin'd, or no, it is certain that *Experimenting* is, like that which is called *Decence* in human Life: which, though it be that, by which all our Actions are to be fashioned, and though many things may be plausibly said upon it; yet it is never wholly to be reduced to standing *Precepts*, and may almost as easily be *obtain'd*, as defin'd.

Their other Care has been, to regard the *least* and the *plainest* Things, and those that may appear at *first* the most *inconsiderable*, as well as the *greatest Curiosities*. This was visibly neglected by the *Antients*. The *Histories* of *Pliny*, *Aristotle*, *Solinus*, *Ælian*, abounding more with pretty Tales, and fine monstrous Stories, than sober and fruitful Relations. If they could gather together some extraordinary Qualities of *Stones* or *Minerals*, some Rarities of the *Age*, the *Food*, the *Colour*, the *Shapes* of *Beasts*, or some *Virtues* of *Fountains*, or *Rivers*, they thought they had performed the chiefest Part of *Natural Historians*. But this Course is subject to much Corruption: It is not the true following of *Nature*; for that still goes on in a steady Road, nor is it so extravagant, and so artificial in its Contrivances, as our Admiration, proceeding from our Ignorance, makes it. It is also a Way that, of all others, is most subject to be deceived; for it will make Men inclinable to bend the Truth much awry, to raise a specious Observation out of it. It stops the severe Progress of *Inquiry*, infecting the Mind, and making it averse from the true *Natural Philosophy*: It is like *Romances*, in respect of *True History*; which,

by multiplying Varities of extraordinary Events and surprising Circumstances, makes that seem dull and tasteless. And, to say no more, the very Delight which it raises, is nothing so solid; but, as the Satisfaction of *Fancy*, it affects us a little in the beginning, but soon wearies and surfeits: Whereas a just *History* of *Nature*, like the Pleasure of *Reason*, would not be, perhaps, so quick and violent, but of far longer Continuance in its Contentment.

Their *Matter* being thus collected, has been brought before their *weekly Meetings*, to undergo a just and a full Examination. In them their principal Endeavours have been, that they might enjoy the Benefits of a *mix'd Assembly*, which are Largeness of Observation, and Diversity of Judgments, without the Mischiefs that usually accompany it; such as Confusion, Unsteadiness, and the little Animosities of divided Parties. That they have avoided these Dangers for the time past, there can be no better Proof than their constant Practice; wherein they have perpetually preserved a singular Sobriety of debating, Slowness of consenting, and Moderation of dissenting. Nor have they been only free from *Faction*, but from the very *Causes* and *Beginnings* of it. It was in vain for any Man amongst them, to strive to prefer himself before another; or to seek for any great Glory from the Subtilty of his Wit; seeing it was the inartificial Process of the *Experiment*, and not the *Acuteness* of any Commentary upon it, which they have had in Veneration. There was no Room left, for any to attempt to heat their own, or other's Minds, beyond a due Temper; where they were not allowed to expatiate, or amplify, or connect specious Arguments together.

Sect. XIV.
Their weekly Assemblies.

They could not be much exasperated one against another in their Disagreements, because they acknowledge, that there may be several Methods of Nature; in producing the same Thing, and all equally good; whereas they that contend for Truth by talking, do commonly suppose that there is but one Way of finding it out. The Differences which should chance to happen, might soon be compos'd; because they could not be grounded on Matters of Speculation, or Opinion, but only of Sense; which are never wont to administer so powerful Occasions of Disturbance and Contention, as the other. In brief, they have escaped the Prejudices that use to arise from Authority, from Inequality of Persons, from Insinuations, from Friendships; but above all, they have guarded themselves against themselves, lest the Strength of their own Thoughts should lead them into Error; lest their good Fortune in one Discovery should presently confine them only to one way of Trial; lest their Failings should discourage, or their Success abate their Diligence. All these *excellent philosophical Qualities* they have by long Custom made to become the peculiar Genius of this *Society*; and to descend down to their Successors, not only as *circumstantial Laws*, which may be neglected, or altered, in the Course of Time, but as the very *Life* of their Constitution; to remain on their Minds, as the *Laws* of *Nature* do in the Hearts of Men; which are so near to us, that we can hardly distinguish, whether they were taught us by Degrees, or rooted in the very Foundation of our Being.

SECT. XV. It will not be here seasonable, to speak much of the *Ceremonies* which they have hitherto observed in these *Meetings*; because they are almost the same, which

which have been since establish'd by their *Council*, which we shall have a more proper Occasion to produce hereafter. Let this only be said in brief, to satisfy the curious.

The *Place* where they hitherto assembled, is *Gresham College*; where, by the Munificence of a Citizen, there have been Lectures for several *Arts* indowed so liberally, that if it were beyond Sea, it might well pass for an *University*. And indeed, by a rare Happiness in the Constitution (of which I know not where to find the like Example) the Professors have been from the Beginning, and chiefly of late Years, of the most learned Men of the Nation; though the Choice has been wholly in the disposal of Citizens. Here the *Royal Society* has one *publick Room* to meet in, another for a *Repository* to keep their Instruments, Books, Rarities, Papers, and whatever else belongs to them; making use besides, by Permission, of several of the other Lodgings, as their Occasions do require. And, when I consider the Place itself, methinks it bears some Likeness to their Design. It is now a *College*, but was once the Mansion-house of one of the *greatest Merchants* that ever was in *England*: And such a *Philosophy* they would build; which should first wholly consist of *Action* and *Intelligence*, before it be brought into *Teaching* and *Contemplation*.

Their Time is every *Wednesday*, after the Lecture of the *Astronomy* Professor; perhaps, in Memory of the first Occasions of the Rendezvouses.

Their Elections, perform'd by Balloting; every Member having a Vote; the Candidates being named at one Meeting, and put to the *Scrutiny* at another.

Their *chief Officer* is the *President*; to whom it belongs to call, and dissolve their *Meetings*; to propose

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the Subject; to *regulate* the Proceedings; to *change* the Inquiry from one thing to another; to *admit* the Members who are elected.

Besides him, they had at first a *Register*, who was to take Notes of all that passed; which were afterwards to be reduced into their *Journals* and *Register Books*. This Task was first *perform'd* by Dr. *Croone*. But they since thought it more necessary, to appoint two *Secretaries*, who are to reply to all Addressees from Abroad, and at Home; and to publish whatever shall be agreed upon by the *Society*. These are at present, Dr. *Wilkins*, and Mr. *Oldenburgh*, from whom I have not usurp'd this first Employment of that Kind; for it is only my Hand that goes, the Substance and Direction came from one of them.

This is all that I have to say concerning their *cere-monial Part*. In most other Things, they bounded themselves to no standing Orders, there being nothing more intended in such Circumstances, than Convenience and Order. If any shall imagine, they have not limited themselves to *Forms* enough, to keep up the Gravity, and Solemnity of such an Enterprize, they are to consider, that so much Exactness and Curiosity of Observances, does not so well besit *Inquirers*, as *Sects* of Philosophy, or Places appointed for Education, or those who submit themselves to the Severity of some religious Order. The Work which the *Society* proposes to itself, being not so fine, and easy, as that of Teaching is: but rather a painful digging, and toiling in *Nature*; it would be a great Incumbrance to them, to be streightned to many strict *Punctilios*; as much as it would be to an *Artificer*, to be loaded with many Clothes, while he is labouring in his Shop.

But

But having made so much Haste thro' the *formal Part of these their Meetings*, I shall not so soon dispatch the *substantial*; which consists in *directing, judging, conjecturing, improving, discoursing*, upon *Experiments*.

Towards the first of these Ends, it has been their usual Course, when they themselves appointed the *Trial*, to propose one Week some particular *Experiments*, to be prosecuted the next; and to debate before Hand, concerning all Things that might conduce to the better carrying them on. In this *preliminary Collection*, it has been the Custom, for any of the *Society*, to urge what came into their Thoughts, or Memories concerning them; either from the Observations of others, or from *Books*, or from their own *Experience*, or even from common *Fame* itself. And in performing this, they did not exercise any great Rigour of choosing and distinguishing between *Truths* and *Falshoods*: but amass all together as they came, the certain Works, the Opinions, the Guesses, the Inventions, with their different Degrees and Accidents, the Probabilities, the Problems, the general Conceptions, the miraculous Stories, the ordinary Productions, the Changes incident to the same Matter in several Places, the Hindrances, the Benefits, of *Airs*, or *Seasons*, or *Instruments*; and whatever they found to have been begun, to have failed, to have succeeded, in the Matter which was then under their Disquisition.

This is a most necessary Preparation, to any that resolve to make a perfect Search. For they cannot but go blindly, and lamely, and confusedly about the Business, unless they have first laid before them a full Account of it. I confess the excellent Monsieur des
Cartes

Sect. XVI.
Their directing Experiments.

Cartes recommends to us another Way in his *philosophical Method*; where he gives this Relation of his own Progress; that after he had run through the usual Studies of Youth, and spent his first Years in an active Life; when he retired to search into *Truth*, he at once rejected all the *Impressions*, which he had before received, from what he had heard and read, and wholly gave himself over to a Reflection on the naked *Ideas* of his own Mind. This he profess'd to do, that he might lay aside all his *old Imaginations*, and begin anew to write on a white and unblotted *Soul*. This, perhaps, is more allowable in Matters of *Contemplation*, and in a *Gentleman*, whose chief Aim was his own Delight; and so it was in his own Choice, whether or no he would go farther to seek it, than his own Mind: But it can by no means stand with a practical and universal *Inquiry*. It is impossible, but they, who will only transcribe their own Thoughts, and disdain to measure or strengthen them by the Assistance of others, should be in most of their Apprehensions too narrow, and obscure; by setting down Things for general, which are only peculiar to themselves. It cannot be avoided, but they will commit many gross Mistakes, and bestow much useless Pains by making themselves wilfully *ignorant* of what is already known, and what concealed. It was tried among the *Antients*, to find out the pure and primitive Language of the World, by breeding up a Child so, that he might never hear any Man speak. But what was the Event of that Trial? Instead of obtaining that End, the Child was made absolutely dumb thereby. And the like Success will that *Philosopher* find, who shall expect, that, by the keeping his Mind free from the *Tincture* of all other *Opinions*, it will give him the original and uninfected

infected *Truths* of Things. All *Knowledge* is to be got the same way that a Language is, by *Industry, Use, and Observation*. It must be receiv'd, before it can be drawn forth. 'Tis true, the Mind of Man is a Glass, which is able to represent to itself, all the Works of *Nature*: But it can only shew those Figures, which have been brought before it: It is no *magical Glass*, like that with which *Astrologers* use to deceive the ignorant; by making them believe, that therein they may behold the Image of any *Place, or Person* in the World, though ever so far remov'd from it. I know it may be here suggested; that they, who busie themselves much abroad about learning the Judgments of others, cannot be unprejudic'd in what they think. But it is not the *knowing*, but the peremptory *Addiction* to others *Tenets*, that sours and perverts the *Understanding*. Nay, to go farther; that Man, who is thoroughly acquainted with all Sorts of *Opinions*, is very much more unlikely, to adhere obstinately to any one particular, than he whose Head is only fill'd with Thoughts, that are all of one Colour.

It being now so requisite, to premise this general Collection, it could not be better made, than by the *joint Labours* of the whole *Society*. It were an intolerable Burthen, if it were wholly cast on the *Experimenters* themselves. For, it is not only true, that those who have the best Faculty of *experimenting*, are commonly most averse from reading Books; and so it is fit, that this *Defect* should be supplied by other Pains: But also it would too much tire, and waste, or at least divert their Spirits, before they came to the main Work: Whereas the *Task* being shar'd amongst so great a Number, will become not much more than a *Business of Delight*. Well then, by

this first *Comment* and *Discourse* upon the *Experiment*; he that is to try it, being present, and having so good an Opportunity, of comparing so many other Men's Conceptions with his own, and with the *Thing* itself, must needs have his Thoughts more enlarg'd, his Judgment confirm'd, his Eyes open'd to discern, what most compendious Helps may be provided; what part of it is more or less useful, and upon what side it may be best attempted: The *Truths*, which he learns this way, will be his Pattern; the *Errors* will be his Sea-marks, to teach to avoid the same Dangers; the very Falshoods themselves will serve to enlarge, though they do not inform his *Understanding*. And, indeed, a thousand more Advantages will hereby come into the Minds of the most sagacious and acute *Inquirers*, which they would never have compass'd, if they had been only left to themselves. I remember my Lord Bacon somewhere says; *That it is one of the greatest Secrets of Nature, that Men's Passions are more capable of being rais'd to higher Degrees in Company, than in Solitude; and that we sooner grieve, fear, rejoice, love, admire, when we behold many others so mov'd, than when we are alone.* This is true; and the same may be as well affirm'd of most other Actions of the Mind. In *Assemblies*, the *Wits* of most Men are sharper, their *Apprehensions* readier, their *Thoughts* fuller, than in their *Closets*. Of this there is an undoubted Proof in the *Art of speaking*. For, let the wittiest and most eloquent Men think as largely as they can, on any Subject in private; yet, when they come into the publick, and especially, when they have heard others speak before them, their *Argument* appears quite another thing to them; their former Expressions seem too flat and cold for their present Thoughts;

Thoughts ; their Minds swell, and are enlightned, as if at that time they were possess'd with the *Souls* of the whole Multitude, before whom they stand.

Those, to whom the Conduct of the *Experiment* Sect. VII. is committed, being dismiss'd with these Advantages, *Their judg-* do, as it were, carry the Eyes and the Imaginations *ing of the* of the whole Company into the *Laboratory* with *Matter of* *Fact.* them. And after they have perform'd the *Trial*, they bring all the *History* of its *Process* back again to the *Test*. Then comes in the second great Work of the *Assembly* ; which is to *judge* and *resolve* upon the Matter of *Fact*. In this Part of their Imployment, they us'd to take an exact View of the Repetition of the whole Course of the *Experiment* ; here they observ'd all the *Chances*, and the *Regularities* of the Proceeding; what *Nature* does willingly, what constrain'd ; what with its own Power, what by the Succours of Art ; what in a constant Road, and what with some kind of Sport and Extravagance ; industriously marking all the various Shapes into which it turns itself, when it is pursued, and by how many secret Passages it at last obtains its End ; never giving it over till the whole *Company* has been fully satisfied of the Certainty and Constancy ; or, on the other side, of the absolute Impossibility of the Effect. This *critical* and *reiterated Scrutiny* of those Things, which are the plain Objects of their Eyes, must needs put out of all reasonable Dispute the Reality of those Operations, which the *Society* shall positively determine to have succeeded. If any shall still think it a just *philosophical Liberty*, to be jealous of resting on their Credit, they are in the right ; and their *Dissentings* will be most thankfully receiv'd, if they be establish'd on solid Works, and not only on *Prejudices*, or

Suspensions. To the *Royal Society* it will be at any time almost as acceptable, to be *confuted*, as to *discover*; seeing, by this means, they will accomplish their main *Design*: others will be inflam'd; many more will labour; and so the *Truth* will be obtain'd between them; which may be as much promoted by the *Contentions* of Hands, and Eyes; as it is commonly injur'd by those of Tongues. However, that Men may not hence undervalue their *Authority*, because they themselves are not willing to impose, and to usurp a *Dominion* over their *Reason*; I will tell them, that there is not any one Thing, which is now approv'd and practis'd in the World, that is confirm'd by stronger Evidence, than this which the *Society* requires; except only the *Holy Mysteries of our Religion*. In almost all other Matters of *Belief*, of *Opinion*, or of *Science*; the Assurance, whereby Men are guided, is nothing near so firm, as this. And I dare appeal to all *sober Men*; whether, seeing in all Countries, that are govern'd by Laws, they expect no more, than the Consent of two or three Witnesses in Matters of Life and Estate; they will not think, they are fairly dealt withal in what concerns their *Knowledge*, if they have the concurring Testimonies of *Threescore or an Hundred*.

Sect. XVIII.
Their conjecturing on the
Causes.

The *History* of the *Trial* perform'd being thus secur'd, I will next declare, what Room they allow'd for conjecturing upon the *Causes*; about which they also took some Pains, though in a far different Way from the antient *Philosophers*; amongst whom, scarce any thing else was regarded; but such *general Contemplations*. This indeed is the *fatal Point*, about which so many of the greatest *Wits* of all Ages have miscarried;

ried; and commonly, the greater the Wit, the more has been the Danger: So many wary Steps ought to be trodden in this uncertain Path; such a Multitude of pleasing *Errors*, false *Lights*, disguised *Lies*, deceitful *Fancies* must be escap'd; so much Care must be taken to get into the right Way at first; so much, to continue in it; and at last, the greatest Caution still remaining to be us'd; lest when the Treasure is in our View, we undo all, by catching at it too soon, with too greedy and rash a Hand. These and many more are the Difficulties to be pass'd; which I have here with less Apprehension reckon'd up, because the Remedy is so nigh. To this *Work* therefore the *Society* approaches, with as much Circumspection and Modesty, as human Counsels are capable of: They have been cautious, to shun the overweening *Dogmatizing* on Causes on the one Hand; and not to fall into a *speculative Scepticism* on the other; and whatever Causes they have with just Deliberation found to hold good they still make them increase their Benefits, by farther experimenting upon them; and will not permit them to rust or corrupt, for want of Use. If after all this, they shall not seem wholly to have remov'd the *Mischiefs*, that attend this *hazardous Matter*; they ought rather to be judg'd, by what they have done towards it above others, than by what they have not provided against; seeing the Thing itself is of that Nature, that it is impossible to place the Minds of Men beyond all Condition of erring about it.

The first *Danger* that I shall observe in this kind, is an *over-hasty*, and *precipitant* concluding upon the *Causes* before the *Effects* have been enough search'd into; a finishing the *Roof* before the *Foundation* has been well laid. For this, I shall first alledge this Cure;

that though the *Experiment* was but the private Task of one or two, or some such small number; yet the *conjecturing*, and *debating* on its *Consequences*, was still the Employment of their full and solemn *Assemblies*. I have already, upon several Occasions, preferr'd *Companies* before *single Endeavours* in *philosophical* Matters; and yet I am not ashamed here to repeat it again; especially, seeing in this place it is most apparent, to which of them the Prerogative of Freedom, and Clearness of Judging belongs. To this Purpose I shall affirm, that there can never be found, in the Breast of any particular *Philosopher*, as much Wariness, and Coldness of Thinking, and rigorous Examination, as is needful, to a solid *Assent*, and to a lasting *Conclusion*, on the whole Frame of *Nature*. How can it be imagin'd, that any single Mind can comprehend and sustain long enough the Weight of so many different *Opinions*, and infinite *Observations*; when even the best *Mathematicians* are soon tir'd with a long Train of the most delightful *Propositions*, which were before made to their Hands? Or, if there could be a Man of that Vastness of *Soul*; yet, how can we be assur'd, that he would hold the *Scale* even? Where have we ever had an Example of so much Streightness and Impartiality of Judgment, to persuade us, that the *calmest Philosopher* will not be insensibly inclin'd to prefer his own *Doctrines*, before those of a Stranger? We see all the World flatter themselves in their *Strength*, *Beauty*, nay, even (as some have noted) in their very *Statures*; the lowest Men scarce believing, but that they are tall enough. Why then should they be singly trusted in their Votes about their own Thoughts; where the Comparison of Wit makes them more eagerly concern'd? If we follow the *Philosopher* home
into

into his Study, we shall quickly discover, by how many *plausible Degrees*, the wisest Men are apt to deceive themselves into a *sudden Confidence* of the Certainty of their Knowledge. We will suppose him to begin his *Inquiry* with all the Sincerity imaginable: resolving to pass by no small Mistake, and to forgive to himself no slight Error in the *Account*; with these *fair Purposes*, he pitches on some *particular Subject*; this he turns and tortures every way, till, after much Labour, he can make some Guesses at its *Causes*: upon this his Industry increases; he applies the same Matter to several other Operations; he still finds the Effects answer his Expectations: Now he begins to mould some *general Proposition* upon it; he meets with more and more Proofs to confirm his *Judgment*: thus he grows, by little and little, warmer in his *Imaginations*; the Delight of his Success swells him; he triumphs and applauds himself for having found out some *important Truth*: But now his Trial begins to slacken; now *Impatience* and *Security* creep upon him; now he carelessly admits whole Crowds of Testimonies, that seem any way to confirm that *Opinion*, which he had before establish'd; now he stops his Survey, which ought to have gone forward to many more *Particulars*; and so at last this *sincere*, this *invincible Observer*, out of Weariness, or Presumption, becomes the most negligent in the latter part of his Work, in which he ought to have been the most exact. Such is the universal Inclination of Mankind, to be misled by themselves; which I have mention'd, not to beat down the Credit of any particular *Philosophers*, whose *Superstructures* have not been answerable to the Strength of their first *Affertions*; but I have only complain'd of it in general, as we use to do of Man's Mortality, and be-
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The HISTORY of

ing subject to Diseases; the aggravating of which common Infirmities can never be esteem'd by any private Man, as an effect of *Malice* or *ill Nature*.

But now, on the other side, this *Doubtfulness* of Thoughts, this *Fluctuation*, this *Slowness* of concluding, which is so useful in this Case, is so natural to a Multitude of Counsellors, that is frequently urg'd against them, as their *inseparable Imperfection*. Every Man has this Argument in his Mouth, wherewith to condemn a great and mixt Number of Advisers; that their *Deliberations* are so tedious, that commonly the *Seasons of Action* are lost, before they can come to any Result. 'Tis true, this Unweildiness, and want of Dispatch, is most destructive in *Matters of State* and *Government*; as Christendom lately felt: But it has a quite contrary influence on *Philosophy*. It is not here the most speedy, or the swiftest Determination of Thoughts, that will do the Business: here many Delays are requir'd: here he that can make a *solid Objection*, or ask a *seasonable Question*, will do more Good, than he who shall boldly fix on a hundred *ill-grounded Resolutions*. Every Rub is here to be smooth'd; every Scruple to be plan'd; every thing to be foreseen; the Satisfaction of the Reason of all past, present, and future Times to be design'd: so that here, that which is so much cried down in *Policy*, a striving still to do better, can never be too much regarded.

Nor is the *Society* only fore-arm'd against this great *Inconvenience*, this Rashness of settling upon Causes, by the Multitude of Judges that are to be satisfied; but also by their indifferent hearing of all *Conjectures*, that may be made from the Tenets of any *Sect of Philosophy*; and by touching every Effect that comes before them, upon all the *Varieties of Opinions*,
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that have been either of late found out, or reviv'd. By this Equality of Respect to all Parties, it has allowed a sufficient Time to ripen whatever it debated: By this too it has made itself the common *Cherisher* and *Umpire* of them all; and has taken the right Way of finding out, what is good in any one of them. A Course, which if the Antients had more followed, their Sects would not so soon have destroy'd each other. It was a most perverse Custom amongst their Disciples, not to make any *strict Choice*, to leave some, and embrace others of their Masters Doctrines, but to swallow all at once. He that became a *Stoick*, an *Epicurean*, a *Peripatetick*, in *Logick*, or *Moral Philosophy*, or *Physicks*, never stuck presently to assent to whatever his Founder had said in all the other Sciences; tho' there was no Kind of Connexion between his Doctrines in the one, and the other. Thus was the whole Image of *Philosophy* formed in their Minds all together: and what they received so carelessly, they defended the same way; not in *Parcels*, but in *Gross*. Of this the Errors are apparent; for by so partially believing all sorts of Tenets, they had no Time to be fully convinc'd; and so became rather *formal* Asserters of them, than *judicious*. And by thus adhering to all, without making any Distinction between the Truths and Falshoods, Weaknesses and Strengths of *their Sects*; they denied to themselves a far more *calm* and *safe Knowledge*, which might have been compounded out of them all, by fetching something from one, and something from another.

This the *Royal Society* did well foresee; and therefore did not regard the Credit of *Names*, but *Things*: rejecting or approving nothing, because of the Title which it bears; preserving to itself the Liberty of re-

fusing or liking, as it found; and so advancing its Stock, by a *sure* and a *double Increase*; by adding *new Discoveries*, and retaining *antient Truths*. A Largeness and Generosity, which certainly is an excellent *Omen* of its Establishment. In this, methinks, it excels any *other Sect*; as the *Roman Commonwealth* did that of *Venice*. The latter began upon a small Stock, and has been careful to preserve itself unmingled, bestowing the Freedom of its City very sparingly: And we see, it has been still on the defensive, making no great Progress in the World; whereas the *Romans*, by a far more frank and honourable Counsel, admitted all, that desired to be their Confederates; gave the Liberty of *Roman Citizens* to whole Towns and Countries; excluded none, but those that would *obstinately* stand out; and so deservedly extended their Empire, as far as the Bounds of the *civil World* did reach.

The second Mischief in this great matter of Causes is an *eternal Instability* and *Aversion* from assigning of any. This arises from a violent and imprudent Haste to avoid the first. So easy is the Passage from one Extreme to another; and so *hard* it is to stop in that little Point, wherein the Right does consist. The Truth is, they are both almost equally pernicious; nothing *sound* is to be expected from those, who will fix blindly on whatever they can lay hold on; and nothing *great* from them, who will always wander; who will never leave disputing, whether they dream, or wake, whether there is any Motion, whether they have any Being, or no; the *one* can produce nothing but *unwholsome* and *rotten* Fruits; and the *other*, for Fear of that, will endeavour to have no *Harvest*, nor *Autumn* at all.

To this Fault of *Sceptical Doubting*, the *Royal Society*

ciety may perhaps be suspected to be a little too much inclined; because they always professed to be so backward from *settling of Principles*; or fixing upon *Doctrines*. But if we fairly consider their Intentions, we shall soon acquit them. Though they are not yet very daring, in establishing Conclusions, yet they lay no Injunctions upon their Successors not to do the same, when they shall have got a sufficient Store for such a Work. It is their Study, that the way to attain a *solid Speculation* should every Day be more and more pursued; which is to be done by a long forbearing of *Speculation* at first, till the Matters be ripe for it; and not by madly rushing upon it in the very beginning. Though they do not contemplate much on the *general* Agreements of Things, yet they do on the *particular*; from whence the others also will in time be deduc'd. They are therefore as far from being *Scepticks*, as the greatest *Dogmatists* themselves. The *Scepticks* deny all, both *Doctrines* and *Works*. The *Dogmatists* determine on *Doctrines*, without a sufficient respect to *Works*: and this Assembly, though we should grant that they have wholly omitted *Doctrines*, yet they have been very positive and affirmative in their *Works*. But more than this, it must also be confess'd, that sometimes after a full Inspection, they have ventured to give the Advantage of Probability to one Opinion, or Cause, above another: Nor have they run any manner of Hazard by thus concluding. For first, it is likely, they did hit the *right*, after so long, so punctual, and so gradual an Examination: or if we suppose the worst, that they should sometimes judge *amiss* (as we cannot but allow they may, seeing it will not be just to bestow Infallibility on them alone, while we deny it to all others)

yet they have taken Care, that their *weaker Reasonings*, and even their *Errors*, cannot be very prejudicial to Posterity. The Causes upon which they have agreed, they did not presently extend beyond their due Strength to all other Things, that seem to bear some Resemblance to what they tried. Whatever they have resolved upon, they have not reported as *unalterable Demonstrations*, but as *present Appearances*; delivering down to future Ages, with the good Success of the Experiment, the Manner of their Progress, the *Instruments*, and the several Differences of the *Matter*, which they have applied; so that with their Mistake, they give them also the Means of finding it out. To this I shall add, that they have never affirmed any thing concerning the Cause, till the Trial was past: whereas, to do it before, is a most venomous thing in the making of *Sciences*; for whoever has fixed on his *Cause* before he has experimented, can hardly avoid fitting his *Experiment*, and his Observations, to his own *Cause*, which he had before imagin'd, rather than the *Cause* to the Truth of the *Experiment* itself. But, in a word, they have hitherto made little other Benefit of the *Causes*, to which they have consented, than that thereby they might have a firm footing, whereon new *Operations* may proceed. And for this Work, I mean a Continuation and Variation of the *Inquiry*, the tracing of a *false* Cause doth very often so much conduce, that, in the Progress, the *right* has been discover'd by it. It is not to be question'd, but many Inventions of great Moment have been brought forth by Authors, who began upon Suppositions, which afterwards they found to be untrue. And it frequently happens to *Philosophers*, as it did to *Columbus*; who first believ'd the *Clouds*, that hover'd about the Continent, to be
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the firm *Land*: But this Mistake was happy; for, by sailing towards them, he was led to what he sought; so by prosecuting of mistaken *Causes*, with a Resolution of not giving over the Pursuit, they have been guided to the *Truth* itself.

The last Defect is the rendring of *Causes* barren; that when they have been found out, they have been suffered to lye idle; and have been only us'd to increase Thoughts, and not Works. This Negligence is of all others the most dangerous; it is a *Shipwrack* in the end of the *Voyage*, and thence the more to be pitied: It is a Corruption, that both hinders Additions, and eats out the Knowledge that has been already obtained: It is the Fault of *Philosophers*, and not of meer *Inquirers*; of those that have been *successful*, and not of the *unfortunate* in their Search; and therefore it is as the Miscarriages of those, that are prosperous in human Actions; which are always observ'd to be more destructive, and harder to be cured, than the Failings of the Afflicted, or those that are still in Pursuit.

To this the *Royal Society* has applied a double Prevention, both by endeavouring to strike out new *Arts*, as they go along; and also, by still improving all to new *Experiments*.

Sect. XIX.
Their way of
Improving.

Of the Possibility of their performing the first, and the Method, which is to be taken about it, I shall shortly speak in another Place: It is enough here, to say, that by this, they have taken Care to satisfy the *Hopes* of the *present Times*; which else might justly languish, and grow cold about this Enterprize; if they once saw, that nothing would be ripe in their Days; but that all was to come up hereafter, for the Advantage of those that are yet unborn. They consulted

the Good of *future* Times, but have not neglected their *own*; they have practis'd both the Parts of *good Husbandry*, planting Trees, and sowing Corn. This latter, for their own speedy Benefit and Support; and the other for the Profit, and Ornament of after-Ages.

Nor have they suffer'd their Diligence to be swallowed up, by the Pleasures and Enjoyments of *present* Discoveries; but have still submitted their noblest Inventions, to be made Instruments and Means for the finding out of *others*. This certainly is the most comprehensive and unerring Method; at once to make use of that Assistance they give, and to force them to be farther helpful to greater Ends. There is nothing of all the Works of Nature so inconsiderable, so remote, or so fully known; but, by being made to reflect on other Things, it will at once enlighten them, and shew itself the clearer. Such is the Dependence amongst all the Orders of Creatures; the inanimate, the sensitive, the rational, the natural, the artificial; that the Apprehension of one of them is a good Step towards the understanding of the rest: And this is the highest Pitch of *human Reason*; to follow all the Links of this Chain, till all their Secrets are open to our Minds, and their Works advanced, or imitated by our Hands. This is truly to command the World; to rank all the *Varieties*, and *Degrees* of Things, so orderly one upon another, that standing on the Top of them, we may perfectly behold all that are below, and make them all serviceable to the Quiet, and Peace, and Plenty of Man's Life. And to this Happiness, there can be nothing else added; but that we make a second Advantage of this *rising Ground*, thereby to look the nearer into Heaven:

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An Ambition, which though it was punished in the old World by an *universal Confusion*; when it was managed with *Impiety* and *Insolence*; yet, when it is carried on by that *Humility* and *Innocence*, which can never be separated from true Knowledge; when it is designed, not to *brave* the Creator of all Things, but to *admire* him the more; it must needs be the utmost Perfection of *human Nature*.

Thus they have directed, judg'd, conjectur'd upon, and improved *Experiments*. But lastly, in these, and all other Businesses, that have come under their Care; there is one thing more, about which the *Society* has been most solicitous; and that is, the manner of their *Discourse*; which, unless they had been very watchful to keep in due Temper, the whole Spirit and Vigour of their *Design* had been soon eaten out, by the Luxury and Redundance of *Speech*. The ill Effects of this Superfluity of Talking, have already overwhelm'd most other *Arts* and *Professions*; insomuch, that when I consider the Means of *happy Living*, and the Causes of their Corruption, I can hardly forbear recanting what I said before; and concluding, that *Eloquence* ought to be banished out of all *civil Societies*, as a thing fatal to Peace and good Manners. To this Opinion I should wholly incline, if I did not find, that it is a *Weapon*, which may be as easily procur'd by *bad Men*, as *good*; and that, if these should only cast it away, and those retain it; the *naked Innocence* of Virtue would be, upon all Occasions, expos'd to the *armed Malice* of the Wicked. This is the chief Reason, that should now keep up the Ornament of Speaking in any Request; since they are so much degenerated from their original Usefulness. They were at first,

Sect. XX.
Their manner of Discourse.

no doubt, an admirable Instrument in the Hands of *wise Men*; when they were only employ'd to describe *Goodness, Honesty, Obedience*, in larger, fairer, and more moving Images; to represent *Truth* cloath'd with Bodies, and to bring *Knowledge* back again to our very Senses, from whence it was at first deriv'd to our Understandings. But now they are generally chang'd to worse Uses; they make the Fancy disgust the best Things, if they come sound and unadorn'd; they are in open Defiance against *Reason*; professing not to hold much Correspondence with that; but with its Slaves, the *Passions*; they give the Mind a Motion too changeable and bewitching, to consist with *right Practice*. Who can behold, without Indignation, how many Mists and Uncertainties, these specious *Tropes* and *Figures* have brought on our Knowledge? How many Rewards, which are due to more profitable and difficult *Arts*, have been still snatch'd away by the easy Vanity of *fine Speaking*! For now I am warm'd with this just Anger, I cannot withhold my self, from betraying the Shallowness of all these seeming Mysteries; upon which, we *Writers*, and *Speakers*, look so big. And in few Words, I dare say, that of all the Studies of Men, nothing may be sooner obtain'd, than this vicious Abundance of *Phrase*, this Trick of *Metaphors*, this Volubility of *Tongue*, which makes so great a Noise in the World. But I spend Words in Vain; for the Evil is now so inveterate, that it is hard to know whom to *blame*, or where to begin to *reform*. We all value one another so much, upon this beautiful Deceit; and labour so long after it, in the Years of our Education; that we cannot but ever after think kinder of it, than it deserves. And indeed, in most other Parts of Learning, I look on it to be a Thing almost

most utterly desperate in its Cure; and I think it may be plac'd amongst those *general Mischiefs*; such as the *Dissention* of Christian Princes, the *Want of Practice* in Religion, and the like; which have been so long spoken against, that Men are become insensible about them; every one shifting off the Fault from himself to others; and so they are only made bare Common Places of Complaint. It will suffice my present Purpose, to point out, what has been done by the *Royal Society*, towards the correcting of its Excesses in *natural Philosophy*; to which it is, of all others, a most profest Enemy.

They have therefore been more rigorous in putting in Execution the only Remedy, that can be found for this *Extravagance*; and that has been a constant Resolution, to reject all the Amplifications, Digressions, and Swellings of Style; to return back to the primitive Purity and Shortness, when Men deliver'd so many *Things*, almost in an equal Number of *Words*. They have exacted from all their Members, a close, naked, natural way of Speaking; positive Expressions, clear Senses; a native Easiness; bringing all Things as near the mathematical Plainness as they can; and preferring the Language of Artizans, Countrymen, and Merchants, before that of Wits, or Scholars.

And here, there is one Thing not to be pass'd by; which will render this establish'd Custom of the *Society* well nigh everlasting; and that is the general Constitution of the Minds of the *English*. I have already often insisted on some of the Prerogatives of *England*; whereby it may justly lay Claim, to be the Head of a *philosophical League*, above all other Countries in *Europe*: I have urg'd its Situation, its present Genius, and the Disposition of its Merchants; and

many more such *Arguments* to encourage us, still remain to be us'd: But of all others, this which I am now alledging, is of the most weighty and important Consideration. If there can be a true Character given of the *universal Temper* of any Nation under Heaven; then certainly this must be ascrib'd to our Countrymen; that they have commonly an unaffected Sincerity; that they love to deliver their Minds with a sound Simplicity; that they have the middle Qualities, between the reserv'd subtile Southern, and the rough unhewn Northern People; that they are not extremely prone to speak; that they are more concern'd what others will think of the Strength, than of the Fineness of what they say; and that an universal Modesty possesses them. These Qualities are so conspicuous, and proper to our Soil; that we often hear them objected to us, by some of our Neighbour Satyrists, in more disgraceful Expressions. For they are wont to revile the *English*, with a want of Familiarity; with a melancholy Dumpishness; with Slowness, Silence, and with the unrefin'd Sullenness of their Behaviour. But these are only the Reproaches of Partiality, or Ignorance; for they ought rather to be commended for an honourable Integrity; for a Neglect of Circumstances and Flourishes; for regarding Things of *greater* Moment, more than *less*; for a Scorn to deceive as well as to be deceived; which are all the best Indowments, that can enter into a *philosophical Mind*. So that even the Position of our Climate, the Air, the Influence of the Heaven, the Composition of the *English* Blood; as well as the Embraces of the Ocean, seem to join with the Labours of the *Royal Society*, to render our Country a Land of *experimental Knowledge*. And it is a good Sign, that

Nature

Nature will reveal more of its Secrets to the *English*, than to others; because it has already furnish'd them with a Genius so well proportioned, for the receiving and retaining its Mysteries.

And now, to come to a Close of the second Part of the *Narration*: The *Society* has reduc'd its principal Observations, into one *common Stock*; and laid them up in publick *Registers*, to be nakedly transmitted to the next Generation of Men; and so from them, to their Successors. And as their Purpose was, to heap up a mixt Mass of *Experiments*, without digesting them into any perfect Model; so to this End, they confin'd themselves to no order of Subjects; and whatever they have recorded. they have done it, not as complete Schemes of Opinions, but as bare unfinished Histories.

In the Order of their *Inquisitions*, they have been so free, that they have sometimes committed themselves to be guided, according to the Seasons of the Year; sometimes, according to what any Foreigner, or *English* Artificer, being present, has suggested; sometimes, according to any extraordinary Accident in the Nation, or any other Casualty, which has hapned in their Way. By which roving and unsettled Course, there being seldom any Reference of one Matter to the next; they have prevented others, nay even their own Hands, from corrupting or contracting the Work; they have made the raising of *Rules* and *Propositions*, to be a far more difficult Task, than it would have been, if their *Registers* had been more *Methodical*. Nor ought this Neglect of Consequence and Order, to be only thought to proceed from their *Carelessness*; but from a mature and well grounded

Sect. II.
*Their way of
Registering.*

Premeditation. For it is certain, that a too sudden Striving to reduce the *Sciences*, in their Beginnings, into Method, and Shape, and Beauty, has very much retarded their Increase. And it happens to the Invention of Arts, as to Children in their younger Years; in whose Bodies, the same *Applications*, that serve to make them strait, slender, and comely, are often found very mischievous, to their Ease, their Strength, and their Growth.

By their fair, and equal, and submissive way of *Registering* nothing but *Histories*, and *Relations*; they have left room for others, that shall succeed, to *change*, to *augment*, to *approve*, to *contradict* them at their Discretion. By this, they have given *Posterity* a far greater Power of judging them, than ever they took over those that went before them. By this, they have made a firm *Confederacy*, between their own *present Labours*, and the Industry of *future Ages*; which how beneficial it will prove hereafter, we cannot better guess, than by recollecting, what Wonders it would in all Likelihood have produc'd e'er this, if it had been begun in the Times of the *Greeks*, or *Romans*, or *Schoolmen*; nay even in the last Resurrection of Learning. What Depth of *Nature* could by this Time have been hid from our View? What Faculty of the Soul would have been in the dark? What Part of human Infirmities not provided against? If our Predecessors, a thousand, nay even a hundred Years ago, had begun to add by little and little to the Store, if they would have endeavour'd to be *Benefactors*, and not *Tyrants* over our Reasons; if they would have communicated to us, more of their *Works*, and less of their *Wit*.

This Complaint, which I here take up, will appear
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the juster, if we consider, that the first *learned Times* of the Antients, and all those, that follow'd after them, down to this Day, would have receiv'd no Prejudice at all ; if their *Philosophers* had chiefly bestow'd their Pains, in making *Histories of Nature*, and not in *forming of Sciences*. Perhaps indeed the Names of some particular Men, who had the Luck to compile those *Systems* and *Epitomes* which they gave us, would have been less glorious than they are : Though that too might be doubted ; and (if we may conclude any Thing surely, upon a Matter so changeable as *Fame* is) we have reason enough to believe, that these latter Ages would have honour'd *Plato*, *Aristotle*, *Zeno*, and *Epicurus*, as much, if not more, than now they do ; if they had only set Things in a way of propagating Experiences down to us, and not impos'd their *Imaginations* on us, as the only *Truths*. This may be well enough suppos'd, seeing it is common to all Mankind, still to esteem dearer the Memories of their *Friends*, than of those that pretend to be their *Masters*.

But this Matter of *Reputation*, was only the *private* Concernment of five, or six. As for the Interest of those Times in general, I will venture to make good, that in all Effects of *true Knowledge*, they might have been as happy, without those *Bodies of Arts*, as they were with them ; *Logick*, and the *Mathematicks* only excepted. To instance in their *Physicks* ; they were utterly useless, in respect of the good of Mankind ; they themselves did almost confess so much, by reserving their *natural Philosophy*, for the Retirements of their wise Men. What Help did it ever bring to the Vulgar ? What visible Benefit to any City or Country in the World ? Their *Mechanicks*, and *Artificers* (for whom the

the true *natural Philosophy* should be principally intended, were so far from being assisted by those *abstruse Doctrines*; that perhaps scarce any one of those Professions, and Trades, has well understood *Aristotle's Principles of Bodies*, from *his own* Time down to *ours*. Hence then we may conclude, that those *first Times*, wherein these *Arts* were made, had been nothing damag'd; if, instead of raising so many *speculative Opinions*, they had only minded the laying of a *solid Ground-work*, for a vast Pile of *Experiments*, to be continually augmenting through all Ages.

And I will also add; that, if such a Course had been at first set on Foot, *Philosophy* would by this means have been kept closer to *material Things*; and so, in Probability, would not have undergone so many *Eclipses*, as it has done ever since. If we reckon from its first setting forth in the *East*; we shall find, that in so long a Tract of Time, there have not been above four or five hundred Years, at several Intervals, wherein it has been in any Request in the World. And if we look back on all the Alterations and Subversions of *States*, that have hapned in civil Nations, these three thousand Years; we may still behold, that the *Sciences of Men's Brains*, have been always subject to be far more injur'd by such Vicissitudes, than the *Arts of their Hands*. What Cause can be assign'd for this? Why was Learning the first thing, that was constantly swept away, in all Destructions of Empire, and foreign Inundations? Why could not that have weather'd out the Storm, as well as most Sorts of Manufactures; which, though they began as soon, or before the other, yet they have remain'd, through all such Changes, unalter'd; except for the better? The Reason of this is evident. It is, because *Philosophy* had been spun out,

out to so fine a Thread, that it could be known but only to those who would throw away all their whole Lives upon it. It was made too subtil for the *common* and *gross* Conceptions of Men of Business. It had before in a measure been banish'd by the Philosophers themselves, out of the World, and shut up in the Shades of their Walks. And by this means, it was first look'd upon as most *useless*, and so fit soonest to be *neglected*. Whereas if at first, it had been made to converse more with the Senses, and to assist familiarly in all Occasions of *human Life*; it would, no doubt, have been thought needful to be preserv'd, in the most *active* and *ignorant* Time. It would have escap'd the Fury of the barbarous People, as well as the Arts of *Ploughing, Gardening, Cookery, Making Iron and Steel, Fishing, Sailing*, and many more such necessary Handicrafts have done.

And it is too late to lament this Error of the Antients, seeing it is not now to be repair'd. It is enough, that we gather from hence, that by bringing *Philosophy* down again to Men's Sight and Practice, from whence it was flown away so high, the *Royal Society* has put it into a Condition of standing out against the Invasions of *Time*, or even *Barbarism* itself; that by establishing it on a firmer Foundation than the *airy Notions* of Men alone, upon all the *Works of Nature*; by turning it into one of the *Arts of Life*, of which Men may see there is daily need; they have provided, that it cannot hereafter be extinguish'd, at the Loss of a Library, at the Overthrowing of a Language, or at the Death of some few *Philosophers*; but that Men must lose their *Eyes* and *Hands*, and must leave off desiring to make their *Lives* convenient or pleasant before they can be willing to *destroy* it.

Thus

SECT. XXI. Thus far I was come in my intended *Work*, when
The Occasion of the Hindrance of the publishing this History. my *Hand* was stop'd, and my *Mind* disturb'd from writing, by the two greatest Disasters that ever befel our *Nation*, the *fatal Infection*, which overspread the City of *London* in sixty five, and the *dreadful firing* of the City itself in the Year ensuing. These two Calamities may well be sufficient to excuse the *Delay* of publishing this *Book*; when the one of them devour'd as many *Men*, and the other as many *Books*, as the cruellest Incurſion of the *Goths* and *Vandals* had ever done.

The *Plague* was indeed an irreparable Damage to the whole Kingdom; but that which chiefly added to the Misery, was the *Time* wherein it happen'd. For what could be a more deplorable Accident, than that so many *brave Men* should be cut off by the *Arrow that flies in the dark*, when our Country was engag'd in a *foreign War*, and when their Lives might have been honourably ventur'd on a glorious Theatre in its Defence? And we had scarce recover'd this *first Misfortune*, when we receiv'd a *second* and a deeper Wound; which cannot be equal'd in all *History*, if either we consider the Obscurity of its *Beginning*, the irresistible Violence of its Progress, the Horror of its *Appearance*, or the Wideness of the Ruin it made, in one of the most renown'd *Cities* of the World.

Yet when, on the one side, I remember what *Desolation* these Scourges of Mankind have left behind them; and on the other, when I reflect on the *Magnanimity* wherewith the *English* Nation did support the Mischiefs; I find, that I have not more Reason to *bewail* the one, than to *admire* the other.

Upon

Upon our Return after the abating of the Plague, what else could we expect, but to see the Streets unfrequented, the *River* forsaken, the *Fields* deform'd with the *Graves* of the *dead*, and the Terrors of *Death* still abiding on the Faces of the living? But instead of such dismal Sight, there appeared almost the same Throngs in all publick Places, the same Noise of *Business*, the same Freedom of Converse, and, with the Return of the *King*, the same Chearfulness returning on the Minds of the People as before.

Nor was their *Courage* less, in sustaining the *second Calamity*, which destroyed their *Houses* and *Estates*. This the greatest Losers indur'd with such undaunted Firmness of Mind, that their Example may incline us to believe, that not only the best *natural*, but the best *moral* Philosophy too, may be learn'd from the Shops of Mechanicks. It was indeed an admirable Thing to behold, with what *Constancy* the meanest Artificers saw all the *Labours* of their *Lives*, and the *Support* of their *Families* devoured in an instant. The Affliction, it is true, was widely spread over the whole Nation; every Place was fill'd with Signs of *Pity* and *Commiseration*; but those who had suffered most, seem'd the least affected with the Loss: No *unmanly Bewailings* were heard in the few Streets that were preserved; they beheld the Ashes of their *Houses*, and *Gates*, and *Temples*, without the least Expression of Pusillanimity. If *Philosophers* had done this, it had well become their Profession of Wisdom; if Gentlemen, the Nobleness of their *Breeding* and *Blood* would have required it: But that such Greatness of Heart should be found amongst the poor *Artizans*, and the obscure Multitude, is no doubt one of the most honourable Events that ever happen'd. Yet still there is one *Circumstance* be-

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hind, which may raise our Wonder higher; and that is, that amidst such horrible *Ruins*, they still prosecuted the *War* with the same *Vigour* and *Courage*, against three of the most powerful States of all *Europe*. What Records of Time, or Memory of past Ages, can shew us a greater Testimony of an invincible and heroick *Genius* than this, of which I now speak? that the Sound of the *Heralds* proclaiming new *Wars* should be pleasant to the People, when the sad Voice of the *Bell-man* was scarce yet gone out of their Ears? That the Increase of their Adversaries *Confederates*, and of their own *Calamities*, should be so far from affrighting them; that they rather seem'd to receive from thence a new *Vigour* and *Resolution*? and that they should still be eager upon *Victories* and *Triumphs*, when they were thought almost quite exhausted, by so great Destructions?

Sect. XXII.
The third
Part of the
Narration.

From this *Observation* my Mind begins to take Comfort, and to presage, that as this *terrible Disease* and *Conflagration*, were not able to darken the Honour of our *Prince's Arms*; so they will not hinder the many noble *Arts*, which the *English* have begun under his *Reign*, on the Strength of these Hopes and Encouragements. I will now return to my former Thoughts, and to the finishing of my interrupted *Design*. And I come with the more Earnestness to perfect it, because it seems to me, that from the sad Effects of these Disasters, there may a new and a powerful *Argument* be raised, to move us to double our Labours about the *Secrets of Nature*.

A new City is to be built, on the most advantageous Seat of all *Europe* for Trade and Command. This therefore is the fittest Season for Men to apply their Thoughts

Thoughts to the improving of the *Materials* of Building, and to the inventing of better *Models* for *Houses*, *Roofs*, *Chimnies*, *Conduits*, *Wharfs*, and *Streets*: all which have been already under the Consideration of the *Royal Society*; and that too, before they had such a sad Occasion of bringing their *Observations* into Practice. The Mortality of this *Pestilence* exceeded all others of later Ages; but the Remembrance of it should rather enliven than damp our *Industry*. When Mankind is over-run with such horrible Invasions of *Death*, they should from thence be universally alarm'd, to use more Diligence about preventing them for the future.

It is true, that terrible *Evil* has hitherto, in all Countries, been generally too strong for the former Remedies of *Art*. But why should we think, that it will continue so for ever? Why may we not believe, that in all the vast Compass of natural Virtues of Things yet conceal'd, there is still reserv'd an *Antidote*, that shall be equal to this Poison? If in such Cases we only accuse the *Anger* of *Providence*, or the *Cruelty* of *Nature*, we lay the Blame where it is not justly to be laid. It ought rather to be attributed to the *Negligence* of Men themselves, that such *difficult Cures* are without the Bounds of their *Reason's Power*.

If all Men had desponded at first, and sunk under the Burden of their own *Infirmities*, almost every little Wound, or Pain of the least *Member*, had been as deadly, as the *Plague* at this time. It was by much Inquiry, and Use, that most of the mildest Diseases became *curable*. And every first Success of this kind, should always strengthen our Assurance of farther Conquests, even over this greatest Terror of Mankind. Distrust, and Despair of our own Endeavours, is as

The HISTORY of

great Hindrance in the Progress of the *true Philosophy*, as it is wont to be in the Rise of Men's private Fortunes. Whoever aims not at the greatest Things, will seldom proceed much farther than the least. Whoever will make a right and a fortunate Courtship to *Nature*, he cannot enterprize or attempt too much: for *She* (as it is said of other *Mistresses*) is also a *Mistress*, that soonest yields to the *forward*, and the *bold*.

I have hitherto described the first *Elements*, on which the *Royal Society* arose, and supported its Beginnings: I have trac'd its Progress from the first private Endeavours of some of its *Members*, till it became united into a *regular Constitution*; and from thence I have related their first *Conceptions* and *Practices*, towards the settling of an universal, constant, and impartial Survey of the whole *Creation*. There now remains to be added in this third Part of my *Narration*, an Account of the *Incouragements* they have received from abroad, and at home, and a particular Enumeration of the *principal Subjects*, about which they have been employed, since they obtain'd the *Royal Confirmation*.

SECT. XXIII. I will first begin with the *Esteem*, which all the civil World abroad has conceived of their *Enterprise*: And I mention this with the more Willingness, because I believe that our *Nation* ought justly to be reprov'd, for their Excess of natural *Bashfulness*, and for their want of Care, to have their most excellent Things represented to Strangers with the best Advantage. This silent and reserv'd Humour has no doubt been very prejudicial to us, in the Judgment that our Neighbours have often made, not only concerning the Condition,

SECT. XXIII.
The Reputation and Correspondence of the R. S. abroad.

dition of our *Learning*, but also of our *political Affairs*. I will therefore trespass a little on this *Disposition* of my *Countrymen*, and affirm, that as the *English* Name does manifestly get Ground, by the Bravery of their *Arms*, the Glory of their *Naval Strength*, and the spreading of their *Commerce*; so there has been a remarkable Addition to its Renown, by the Success, which all our *Neighbours* expect from this *Assembly*.

It is evident, that this *searching Spirit*, and this Affection to *sensible Knowledge*, does prevail in most Countries round about us. 'Tis true, the Conveniences for such Labours are not equal in all Places. Some want the Assistance of others *Hands*; some the Contribution of others *Purses*; some the Benefit of excellent *Instruments*, some the *Patronage* of the Civil *Magistrates*: But yet according to their several *Powers*, they are every where intent on such *practical Studies*. And the most considerable Effects of such Attempts throughout *Europe* have been still recommended to this *Society*, by their *Authors*, to be examined, approved, or corrected:

The Country, that lyes next to *England* in its Situation is *France*; and that is also the nearest to it, in its Zeal for the Promotion of *Experiments*. In that Kingdom, the *Royal Society* has maintained a perpetual Intercourse, with the most eminent Men of *Art* of all Conditions; and has obtained from them, all the Help which might justly be hoped for, from the *Vigour*, and *Activity*, and *Readiness* of Mind, which is natural to that People. From their *Physicians*, *Chirurgeons*, and *Anatomists*, it has receiv'd many faithful *Relations* of extraordinary *Cures*; from their most judicious *Travellers* the Fruits of their *Voyages*; from their

In France.

most famous *Mathematicians*, diverse *Problems*, which have been solved many different Ways; from their *Chymists* the effects of their *Fires*; and from others of their best *Observers*, many Rarities, and Discourses of their *Fruits, Silk, Wine, Bread, Plants, Salt*, and such natural Productions of their Soil. And to instance once for all, it has been affectionately invited to a mutual Correspondence by the *French Academy of Paris*: In which Invitation, there is one Expression, that ought not to be pass'd over in Silence; that they acknowledge the *English Nation*, to have many Advantages for the propagating of *real Philosophy*, which are wanting to all others. This Confession is true: Yet these Advantages, unless they had been improved by this *Institution*, had been only as those, that we have for Fishing, Objections and Arguments of our Sloth.

In Italy.

In *Italy* the *Royal Society* has an excellent Privilege of receiving and imparting *Experiments*, by the Help of one of their own *Fellows*, who has the Opportunity of being *Resident* there for them, as well as for the *King*. From thence they have been earnestly invited to a mutual Intelligence, by many of their most noble Wits, but chiefly by the Prince *Leopoldo*, Brother to the Great Duke of *Tuscany*; who is the Patron of all the *inquisitive Philosophers of Florence*; from whom there is coming out under his Name an Account of their Proceedings, called *Ducal Experiments*. This Application to the *Royal Society* I have mention'd, because it comes from that Country, which is seldom wont to have any great Regard to the *Arts* of these *Nations*, that lye on this side of their Mountains.

In Germany. In *Germany*, and its neighbouring Kingdoms, the
Royal

Royal Society has met with great Veneration; as appears by several Testimonies in their late *printed Books*, which have been submitted to its Censure; by many Curiosities of *Mechanick Instruments*, that have been transmitted to it; and by the *Addresses* which have been sent from their *Philosophical Inquirers*. For which Kinds of Enterprizes the Temper of the *German Nation* is admirably fit, both in respect of their peculiar Dexterity in all Sorts of manual *Arts*, and also in Regard of the plain and unaffected Sincerity of their *Manners*; wherein they so much resemble the *English*, that we seem to have deriv'd from them the Composition of our *Minds*, as well as to have descended from their *Race*.

In the *Low-Countries*, their Interest, and Reputation has been established, by the Friendship of some of *In the Low-Countries*, their chief learned Men, and principally of *Hugenius*. This Gentleman has bestowed his Pains, on many Parts of the *speculative* and *practical Mathematicks*, with wonderful Successes. And particularly his applying the Motion of *Pendulums* to Clocks, and Watches, was an excellent *Invention*. For thereby there may be a Means found out of bringing the *Measures of Time*, to an exact *Regulation*; of which the Benefits are infinite. In the Prosecution of such *Discoveries*, he has often required the Aid of this *Society*; he has receiv'd the Light of their *Trials*, and a Confirmation of his own, and has freely admitted their *Alterations* or *Amendments*. And this learned Correspondence with him, and many others, is still continued, even at this present Time, in the Breach between our *Countries*: Their great Founder, and Patron still permitting them to maintain the Traffick of Sciences, when all other

other *Commerce* is intercepted. Whence we may guess, what may be expected from the peaceful Part of our King's Reign, when his very Wars are managed without Injury to the Arts of *Civil Knowledge*.

Visits of Foreigners.

But not to wander any farther in *Particulars*, it may perhaps in *general* be safely computed, that there has been as large a Communication of Foreign *Arts*, and *Inventions* to the *Royal Society*, within this small Compass of Time, as ever before did pass over the *English Channel*, since the very first Transportation of Arts into our *Island*. And that this Benefit will still increase by the Length of Time is indubitable, from the *Reception*, which has been given to the *Scholars, Nobility, Embassadors*, and Foreign *Princes*, who of late Years have travell'd hither, to behold a *Country*, which had been the Stage of so famous a War, and so miraculous a Peace. All these have still visited the *Royal Society*, as one of the first and *noblest Fruits* of our *Restoration*. From hence they have return'd Home, with a free Engagement of their Assistance; the *Men* of Learning assuring it of a Contribution of their *Labours*, and the *Statesmen* and *Princes* of their *Authority* and Endeavours, in satisfying all *philosophical Queries*, with which they have been plentifully furnished.

It would be a useless Pomp to reckon up a *Catalogue* of their *Names*; especially seeing they are already recorded with Gratitude, in a more lasting Monument, the *Register* of the *Society*. Only it will not, I think, be amiss, if I mention the Visit of one *Prince*, because it may afford us a profitable Observation, When the Duke of *Brunswick* and *Lunenburgh* was introduced into their weekly *Assembly*, and had subscribed his Name to their *Statutes*; there was accord-

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ding to the Custom, one of the *Fellows* appointed, to interpret to him, what Experiments were produc'd, and examin'd at that Meeting. But his *Highness* told them, that it was not necessary they should put themselves to that Trouble; for he well understood our Language, having been drawn to the Study of it, out of a desire of reading our *Philosophical Books*. From whence there may this Conclusion be made, that if ever our *Native Tongue* shall get any Ground in *Europe*, it must be by augmenting its *experimental Treasure*. Nor is it impossible, but as the *Feminine Arts of Pleasure and Gallantry* have spread some of our neighbouring Languages to such a vast Extent; so the *English Tongue* may also in Time be more enlarg'd, by being the Instrument of conveying to the World the *Masculine Arts of Knowledge*.

I now come to relate, what *Incouragements* this ^{Sect. XXIV.} Design has receiv'd at home in its native *Soil*. And I ^{The Incouragements the} will assure my *Reader*, that the *Original* of the *Royal* ^{R. S. has receiv'd at home.} *Society* has found a general *Approbation* within our selves, and that the most prudent Men of all Professions and Interests, have shewn by their Respects to these hopeful Beginnings, that there is a *Reverence* due to the first Trials and Intentions, as well as to the last Accomplishment of generous Attempts.

Of our chief and most wealthy *Merchants* and *Ci-* ^{From our Ci-} *tizens*, very many have assisted it with their Presence; and thereby have added the industrious, punctual, and active *Genius* of Men of *Traffick*, to the quiet, sedentary, and reserv'd Temper of Men of *Learning*. They have contributed their *Labours*; they have help'd their *Correspondence*; they have employ'd
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their *Factors* abroad to answer their *Inquiries*; they have laid out in all Countries for *Observations*; they have bestow'd many considerable Gifts on their *Treasury* and Repository. And chiefly there is one *Bounty* to be here inserted, which for the singular Benefit that may be expected from it, deserves the *Applause* and *Imitation* of this and future Times. It is the *Establishment* made by Sir *John Cutler*, for the reading on *Mechanicks*, in the Place where the *Royal Society* shall meet. This is the first *Lecture* that has been founded of this Kind, amidst all the vast *Munificence* of so many *Benefactors to Learning* in this latter Age. And yet this was the most necessary of all others. For this has chiefly caus'd the slow Progress of *manual Arts*; that the *Trades* themselves have never serv'd *Apprentiships*, as well as the *Tradesmen*; that they have never had any *Masters* set over them, to direct and guide their Works, or to vary and enlarge their Operations.

From our
Physicians.

Of our *Physicians*, many of the most judicious have contributed their *Purses*, their *Hands*, their *Judgments*, their *Writings*. This they have done, though they have also in *London* a College peculiar to their *Profession*; which ever since its first Foundation, for the Space of a hundred and fifty Years, has given the World a Succession of the most eminent *Physicians* of *Europe*. In that they confine themselves to the Advancement of *Physick*: But in this, they have also with great Zeal and Ability promoted this *universal Inspection*, into all *natural Knowledge*. For without Danger of *Flattery*, I will declare of the *English Physicians*, that no Part of the World exceeds them, not only in the Skill of their own *Art*, but in *general Learning*; and of very many of that Profession I will affirm, that all

Apollo is their own, as it was said by the best *Poet* of this Age, of one of the most excellent of their Number.

Of our *Nobility* and *Gentry*, the most noble and illustrious have condescended to labour here with their *Hands*, to impart their *Discoveries*, to propose their *Doubts*, to assist and defray the *Charge* of their *Trials*. And this they have done with such a universal Agreement, that it is almost the only thing, wherein the *Nobility* of all the three Kingdoms are united. In their *Assemblies* for making *Laws* they are separated; in their *Customs* and *Manners* of *Life* they differ; in their *Humours* too, they are thought not much of kin to each other. But in the *Royal Society* the *Scotch*, the *Irish*, the *English* *Gentry* do meet, and communicate, without any Distinction of *Countries* or Affections. From hence no doubt very much *political*, as well as *philosophical* Benefit will arise. By this means, there is a good Foundation laid for removing of that Aversion, which the *English* are sometimes observ'd to express to the *Natives* of those Kingdoms; which though perhaps it arises from the Knowledge of their own *Advantages* above the other, yet it is a great Hindrance to the Growth of the *British Power*. For as a Kingdom divided against itself, cannot stand; so three Kingdoms divided from each other, in *Temper*, *Studies*, and *Inclinations*, can never be great; upon one common Interest.

Of our *Ministers of State at home*, and our *Embassadors abroad*, there have been very few employ'd, who are not *Fellows* of the *Royal Society*: and especially these latter have bestow'd their Pains in *foreign Courts*, to collect *Relations* and *Secrets* of Nature, as well as

of State : For which Service their Way of Life is most convenient, by the Generality of their Converse, the *Privileges* and *Freedom* of their *Dispatches*, and the usual Resort of the most knowing and inquisitive Men to their Company.

From our
Soldiers.

Our greatest *Captains* and *Commanders* have in-roll'd their *Names* in this Number, and have regarded these *Studies* : which are not, as other Parts of *Learning*, to be call'd the *Studies of the Gown* ; for they do as well become the Profession of a *Soldier*, or any other Way of Life. Nor have our most renown'd *Generals* neglected the Opportunities of *philosophical* Inquiries, even in the midst of their greatest *Enterprises*, on which the Fate of *Kingdoms* has depended. They have been furnish'd with Instruments and Directions by the *Royal Society*, and amidst the Tumult of *Wars*, and *Government of Fleets*, they have found Leisure to make some *Trials of Experiments* : which Works as much excell that of *Declaiming*, which some of the *Roman Generals* us'd in their *Camps*, as it is better to do, than to talk well.

From our
Churchmen.

Of our *Churchmen* the greatest and the most *Reverend*, by their Care and Passion, and Endeavours in advancing this *Institution*, have taken off the unjust Scandal from *Natural Knowledge*, that it is an Enemy to *Divinity*. By the perpetual *Patronage* and *Assistance* they have afforded the *Royal Society*, they have confuted the false Opinions of those Men, who believe that *Philosophers* must needs be *irreligious* : they have shewn, that in our *Veneration of God's almighty Power*, we ought to imitate the manner of our Respect to *earthly Kings*. For as the greater their *Dominion* is,

the more Observance is wont to be given to their nearest Servants and Officers; so the Greatness of the *Divine Majesty* is best to be worshipped, by the due honouring and observing of *Nature*, which is his immediate Servant, and the universal *Minister* of his Pleasure.

But I make haste to that, which ought to be esteem'd the very *Life* and Soul of this Undertaking, the Protection and Favour of the *King* and the *Royal Family*. When the *Society* first address'd themselves to his Majesty, he was pleas'd to express much Satisfaction, that this Enterprize was begun in *his Reign*: he then represented to them the Gravity and Difficulty of their Work, and assur'd them of all the kind Influence of his *Power* and *Prerogative*. Since that he has frequently committed many Things to their Search: he has refer'd many foreign Rarities to their *Inspection*: he has recommended many domestick *Improvements* to their Care: he has demanded the Result of their *Trials*, in many Appearances of *Nature*: he has been present, and assist'd with his own Hands, at the performing of many of their *Experiments*, in his *Gardens*, his *Parks*, and on the *River*. And besides I will not conceal, that he has sometimes reprov'd them for the *Slowness* of their *Proceedings*: at which Reproofs they have not so much Cause to be afflicted, that they are the Reprehensions of a *King*, as to be comforted, that they are the Reprehensions of his *Love*, and *Affection* to their Progress. For a Testimony of which *Royal Benignity*, and to free them from all Hindrances and Occasions of Delay, he has given them the Establishment of his *Letters Patents*, of which I will here produce an *Epitome*.

Sect. XXV.
From the
Royal Family.

Charles

CHarles the Second, by the Grace of God, of England, Scotland, France, and Ireland King, Defender of the Faith, &c. To all unto whom these Presents shall come, Greeting. Having long resolved within our self to promote the Welfare of Arts and Sciences, as well as that of our Territories and Dominions, out of our princely Affection to all kind of Learning, and more particular Favour to philosophical Studies: Especially those which endeavour by solid Experiments, either to reform or improve Philosophy. To the intent therefore that these Kinds of Study, which are no where yet sufficiently cultivated, may flourish in our Dominions; and that the learned World may acknowledge us to be, not only the Defender of the Faith, but the Patron and Encourager of all Sorts of useful Knowledge;

Know ye, that we out of our special Grace, certain Knowledge, and meer Motion, have given and granted, and do by these Presents give and grant for us, our Heirs, and Successors, That there shall be for ever a Society, consisting of a President, Council, and Fellows, which shall be called by the Name of the President, Council, and Fellows of the Royal Society of London, for and improving of natural Knowledge, of which Society we do by these Presents declare our self to be Founder and Patron. And we do hereby make and constitute the said Society by the Name, &c. to be a Body corporate, to be continued under the same Name in a perpetual Succession; and that they and their Successors, (whose Studies are to be imployed for the promoting of the Knowledge of natural Things, and useful Arts by Experiments. To the Glory of God, and the good of Mankind,) shall by the aforesaid Name of President, Council, &c. be enabled and made capable in Law, to levy, hold, possess, and enjoy, Lands, Tenements, &c. Liberties,

ties, Franchises, Jurisdictions, for Perpetuity, or Terms of Lives, or Years, or any other Way: as also Goods, Chattels, and all other Things of what Nature or Kind soever. And also by the Name aforesaid to give, grant, demise, or assign the said Lands, Goods, &c. and to do all Things necessary thereabout. And the said Persons by the Name aforesaid are enabled to implead, be impleaded, sue, defend, &c. in any Courts, and before any Judges, Officers, &c. whatsoever of the King, his Heirs, and Successors, in all and singular Actions real and personal: Pleas, Causes, &c. of what kind soever, as any of his Subjects within his Kingdom of England, or Corporations, are by Law capable and enabled to do.

And the said President, Council, and Fellows are empower'd to have a Common Seal for their Use in their Affairs; and from time to time to break, change, and make anew the same, as shall seem expedient unto them.

And his Majesty, in Testimony of his Royal Favour towards the said President, Council, and Fellows, and of his especial Esteem of them, doth grant a Coat of Arms to them and their Successors, viz. On a Field Argent a Canton of the three Lions of England: For a Crest, an Eagle proper on a Ducal Coronet supporting a Shield charged with the Lions aforesaid; and for Supporters, two Talbots with Coronets on their Necks. The said Arms to be born, &c. by the said Society upon all Occasions.

And that his Majesty's Royal Intention may take the better Effect for the good Government of the said Society from time to time: it is establish'd, that the Council aforesaid shall consist of twenty one Persons; (whereof the President for the time being always to be one.) And that all Persons, which within two Months next ensuing the Date of the said Charter shall be chosen by the said

The HISTORY of

said President and Council; and in all times after the said two Months, by the President, Council, and Fellows [and noted in a Register to be kept for that purpose] shall be Fellows of the said Society, and so accounted, and called during Life, except by the Statutes of the said Society to be made, any of them shall happen to be removed. And by how much any Persons are more excellent in all kinds of Learning, by how much the more ardently they desire to promote the Honour, Business, and Emolument of the said Society, by how much the more eminent they are for Integrity, Honesty, Piety, Loyalty, and good Affection toward his Majesty, his Crown and Dignity; by so much the more fit and worthy such Persons are to be judged, for Reception into the Society.

And for the better Execution of his Royal Grant, his Majesty hath nominated, &c. his trusty and well-beloved William, Viscount Brouncker, Chancellor to his dearest Consort Queen Catherine, to be the first and modern President to continue in the said Office from the Date of the Patent to the Feast of St. Andrew next ensuing, and until another Person of the said Council be duly chosen into the said Office. The said Lord Brouncker being sworn in all things belonging thereto well and faithfully to execute the said Office, before his right well-beloved and right trusty Cousin and Counsellor, Edward, Earl of Clarendon, Lord High Chancellor of England, in the Words following.

I *William, Viscount Brouncker, do promise to deal faithfully and honestly in all things belonging to that Trust committed to me, as President of the Royal Society of London, for improving Natural Knowledge. So help me God.*

And

And his Majesty hath nominated, &c. the Persons following, His trusty and well-beloved Sir Robert Moray Knight, one of his Privy Council in his Kingdom of Scotland, Robert Boyle Esquire, William Brereton Esquire, eldest Son to the Lord Brereton, Sir Kenelme Digby Knight, Chancellor to his dearest Mother Queen Mary, Sir Gilbert Talbot Knight, Master of his Jewell-house, Sir Paul Neile Knight, one of the Ushers of his Privy Chamber, Henry Slingsby Esquire, one of the Gentlemen of His said Privy Chamber, Sir William Petty Knight, Timothy Clark, Doctor of Physick, and one of his Physicians, John Wilkins Doctor of Divinity, George Ent Doctor of Physick, William Erskyne Esquire, one of his Cupbearers, Jonathan Goddard Doctor of Physick, William Ball Esquire, Matthew Wren Esquire, John Evelyn Esq. Thomas Henshaw Esquire, Dudley Palmer of Grays-Inn Esquire, Abraham Hill of London Esquire, and Henry Oldenburg Esquire, together with the President aforesaid, to be the first and Modern 21. of the Council and Fellows of the Royal Society aforesaid, to be continued in the Offices of the Council aforesaid, from the Date of the Patent to the Feast of St. Andrew next following, and from thence till other fit Persons be chosen into the said Offices: The said Persons to be sworn before the President of the Society, for the time being, well and truly to execute the said Offices, according to the Form and Effect of the aforesaid Oath to be administred to the President by the Lord Chancellor as aforesaid. For the administring which Oath to the said Persons, and all others hereafter from time to time to be chosen into the said Council, full Power and Authority is granted to the President for the time being: And the said Persons duly sworn, and all other

from time to time duly chosen into the said Council and sworn, are to aid, advise and assist in all Affairs, Businesses, and Things concerning the better Regulation, Government and Direction of the Royal Society, and every Member thereof.

Furthermore, Liberty is granted to the said Society, lawfully to make and hold Meetings of themselves, for the searching out and Discovery of natural Things, and Transaction of other Businesses relating to the said Society, when and as often as shall be requisite, in any College, Hall, or other convenient Place in London, or within ten Miles thereof.

And Power is granted to the said Society, from time to time to nominate and chuse yearly, on St. Andrew's Day, one of the Council aforesaid, for the time being, to be President of the Society, until St. Andrew's Day next ensuing (if he shall so long live, or not be removed for some just and reasonable Cause) and from thence until another be chosen and put into the said Office, the said President so elected, before Admission to that Office, to be sworn before the Council, according to the Form before expressed, who are empower'd to administer the said Oath from time to time, as often as there shall be cause to chuse a President.

And in case that the said President, during his Office, shall die, recede, or be removed; then, and so often, it shall be lawful for the Council of the Royal Society, to meet together to chuse one of their Number for President of the said Society, and the Person so chosen and duly sworn, shall have and exercise the Office of President for the remainder of the Year; and until another be duly chosen into the said Office.

And in case that any one or more of the Council aforesaid shall die, recede, or be removed (which Persons or

any of them, for Misdemeanour, or other reasonable Cause, are declared to be amoveable by the President and the rest of the Council) then and so often it shall be lawful for the President, Council, and Fellows, to chuse one or more of the Fellows of the Royal Society in the room of him or them so deceasing, receding, or remov'd, to compleat the aforesaid Number of twenty one of the Council, which Person or Persons so chosen, are to continue in Office until St. Andrew's Day then next ensuing, and until others be duly chosen the said Persons being sworn faithfully to execute their Offices, according to the true Intention of the Patent.

And his Majesty doth will and grant unto the said President, Council, and Fellows, full Power and Authority, on St. Andrew's Day yearly, to elect, nominate, and change ten of the Fellows of the Royal Society, to supply the Places and Offices of ten of the aforesaid Number of twenty one of the Council, declaring it to be his Royal Will and Pleasure, that ten and no more of the Council aforesaid be annually changed and removed by the President, Council and Fellows aforesaid.

And it is granted on the behalf of the said Society, that if it shall happen, that the President be sick, infirm, detain'd in his Majesty's Service, or otherwise occupied, so as he cannot attend the necessary Affairs of the Society, then and so often it shall be lawful for him to appoint one of the Council for his Deputy, who shall supply his Place from time to time, as often as he shall happen to be absent, during the whole time of the said President's Continuance in his Office, unless he shall in the mean time constitute some other of the Council for his Deputy: And the Deputy so constituted is impowered to do all and singular Things which belong to the Office of the President of the Royal Society, and in as ample Manner and Form as the said President

The HISTORY of

may do by virtue of his Majesty's Letters Patents, be the said Deputy being duly sworn before the Council in Form before specified, who are impower'd to administer the Oath as often as the Case shall require.

It is farther granted to the Society, to have one Treasurer, two Secretaries, two or more Curators of Experiments, one or more Clerk or Clerks, and also two Sergeants at Mace, who may from time to time attend on the President; all the said Officers to be chosen by the President, Council and Fellows, and to be sworn in Form and Effect before specified, well and faithfully to execute their Offices, which Oath the Council are impowered to administer: And his Majesty nominates and appoints his well beloved Subjects, the *aforesaid* William Ball Esquire, to be the first and modern Treasurer; and the *aforesaid* John Wilkins and Henry Oldenburgh, to be the first and modern Secretaries of the Royal Society, to be continued in the said Offices to the Feast of St. Andrew next following the Date of the Patent. And that from time to time and ever hereafter, on the said Feast of St. Andrew (if it be not Lord's Day, and if it be Lord's Day, on the next Day after) the President, Council, and Fellows *aforesaid*, are impower'd to nominate and chuse honest and discreet Men for Treasurer and Secretaries, which are to be of the Number of the Council of the Royal Society, which Persons elected and sworn, in Form before specified, are to exercise and enjoy the said Offices until the Feast of St. Andrew next then following.

And if it shall happen, that the *aforesaid* Election of the President, Council, Treasurer, and Secretaries, or any of them, cannot be made or perfected on the Feast of St. Andrew *aforesaid*; it is granted to the *aforesaid* President, Council, and Fellows, that they may lawfully

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nominate and assign another Day, as near to the said Feast of St. Andrew as conveniently may be, for making or perfecting the said Elections, and so from Day to Day till the said Elections be perfected.

And in case that any of the aforesaid Officers of the Royal Society shall die, recede, or be remov'd from their respective Offices, then and so often it shall be lawful for the said President, Council and Fellows, to choose one or more into the Office or Offices vacant, to hold the same during the Residue of that Year, and until others be duly chosen and sworn in their Places.

Moreover, on the behalf of the Society, it is granted unto the President and Council, that they may assemble and meet together in any College, Hall, or other convenient place in London, or within ten Miles thereof (due and lawful Summons of all the Members of the Council to extraordinary Meetings being always premised) and that they being so met together, have full Power and Authority from time to time, to make, constitute, and establish such Laws, Statutes, Orders, and Constitutions, which shall appear to them to be good, useful, honest, and necessary, according to their Judgments and Discretions, for the Government, Regulation and Direction of the Royal Society, and every Member thereof: And to do all Things concerning the Government, Estate, Goods, Lands, Revenues, as also the Businesses and Affairs of the said Society: All which Laws, Statutes, Orders, &c. so made, His Majesty wills and commands, that they be from time to time inviolably observed, according to the Tenor and Effect of them: Provided that they be reasonable, and not repugnant or contrary to the Laws, Customs, &c. of his Kingdom of England.

*And furthermore, full Power and Authority is given
and*

and granted unto the said Society, from time to time to choose one or more Printers and Gravers, and by writing sealed with the common Seal of the Society, and signed by the President for the time being, to grant them Power to print such Things, Matters and Businesses concerning the said Society, as shall be committed to them by the Council from time to time: The said Printers and Gravers, being sworn before the President and Council in Form before specified, which President and Council are empowered to give the said Oath.

And for the greater Advantage and Success of the Society in their philosophical Studies and Endeavours, full Power and Authority is granted unto them, to require, take, and receive from time to time, dead Bodies of Persons executed, and the same to anatomise, to all Intents and Purposes, and in as ample Manner and Form as the College of Physicians, and Company of Chirurgeons of London (by what Names soever the said two Corporations are or may be called) have had and made use of, or may have and use the said Bodies.

And for the Improvement of such Experiments, Arts, and Sciences, as the Society may be employed in, full Power and Authority is granted unto them from time to time by Letters under the Hand of the President, in the Presence of the Council, to hold Correspondence and Intelligence with any Strangers, whether private Persons, or Collegiate Societies, or Corporations, without any Interruption or Molestation whatsoever: Provided that this Indulgence or Grant be extended to no farther Use than the particular Benefit and Interest of the Society, in Matters Philosophical, Mathematical, and Mechanical.

Full Power and Authority is also granted on the behalf of the Society to the Council, to erect and build one or more Colleges within London, or ten Miles thereof,

thereof, of what Form or Quality soever, for Habitation, Assembling, or Meeting of the President, Council and Fellows, about any Affairs and Businesses of the Society.

And if any Abuses or Differences shall ever hereafter arise and happen about the Government or Affairs of the Society, whence the Constitution, Progress, and Improvement, or Businesses thereof may suffer or be hindered: In such Cases his Majesty assigns and authorises his right trusty and right well beloved Cousin and Counsellor, Edward Earl of Clarendon Lord High Chancellor of England, by himself during his Life, and after his Decease the Lord Archbishop of Canterbury, the Lord Chancellor, or Lord Keeper of the Great Seal of England, the Lord High Treasurer of England, the Lord Keeper of the Privy Seal, the Lord Bishop of London, and the two principal Secretaries of State for the Time being, or any four or more of them, to compose and redress any such Differences or Abuses.

And lastly, his Majesty strictly charges and commands all Justices, Mayors, Aldermen, Sheriffs, Bailiffs, Constables, and all other Officers, Ministers, and Subjects whatsoever, from time to time to be aiding and assisting unto the said President, Council, and Fellows of the Royal Society, in and about all Things, according to the true Intention of his Letters Patent.

This is the *Legal Ratification* which the *Royal Society* has received. And in this Place I am to render their publick Thanks to the Right Honourable the Earl of Clarendon Lord Chancellor of England, to Sir Jeffery Palmer Attorney General, and to Sir Hennege Finch Solicitor General; who by their chearful Concurrence, and free Promotion of this Confirmation, have wiped away the Aspersions, that has been scandalously

scandalously cast on the *Profession* of the *Law*, that it is an Enemy to *Learning* and the *civil Arts*. To shew the Fallshood of this Reproach, I might instance in many *Judges* and *Counsellors* of all Ages, who have been the Ornaments of the *Sciences*, as well as of the *Bar*, and *Courts of Justice*. But it is enough to declare, that my Lord *Bacon* was a *Lawyer*, and that these eminent *Officers* of the *Law*, have completed this Foundation of the *Royal Society*; which was a Work well becoming the Largeness of his Wit to devise, and the Greatness of their Prudence to establish.

Sect. XXIV. According to the Intention of these *Letters Patents*, their *Council* has ever since been annually renewed; their *President*, their *Treasurer*, their *Secretaries* chosen: The chief Employments of the *Council* have been to manage their political Affairs, to regulate Disorders, to make Addresses, and Applications in their Behalf: to regard their *Privileges*, to disperse *Correspondents*, but principally to form the Body of their *Statutes*, which I will here insert.

An Abstract of the Statutes of the Royal Society.

WHATEVER Statute shall be made, or repealed, the making or repealing of it shall be voted twice, and at two several Meetings of the Council.

This Obligation shall be subscribed by every Fellow; or his Election shall be void.

WE who have hereto subscrib'd, do promise each for himself, that we will endeavour to promote the good of the Royal Society of *London*, for the Improvement of natural Knowledge, and to pursue the Ends, for which the same was founded; that we were

will be present at the Meetings of the Society, as often as conveniently we can; especially at the anniversary Elections, and upon extraordinary Occasions; and that we will observe the Statutes and Orders of the said Society: Provided, that whenever any of us shall signify to the President under his Hand, that he desires to withdraw from the Society, he shall be free from this Obligation for the future.

Every Fellow shall pay his Admission-Money, and afterwards Contribution, towards the defraying of the Charges of Observations and Experiments, &c.

The ordinary Meetings of the Royal Society shall be held once a Week, where none shall be present, besides the Fellows, without the leave of the Society, under the Degree of a Baron in one of his Majesty's three Kingdoms, or of his Majesty's Privy Council; or unless he be an eminent Foreigner, and these only without the leave of the President.

The Business of their weekly Meetings shall be, To order, take account, consider, and discourse of, philosophical Experiments and Observations; to read, hear, and discourse upon, Letters, Reports, and other Papers, containing philosophical Matters; as also to view, and discourse upon the Productions and Rarities of Nature, and Art; and to consider what to reduce from them, or how they may be improved for Use or Discovery.

The Experiments that be made at the Charge of the Society; two Curators at least shall be appointed for the Inspection of those which cannot be performed before the Society; by them the bare Report of Matter of Fact shall be stated and returned.

The Election of Fellows shall be made by way of Ballot; and their Admission by a solemn Declaration made by the President of their Election.

The Election of the Council and Officers shall be made once a Year: Eleven of the present Council shall be continued by Lot, for the next Year, and ten new ones chosen in like Manner. Out of this new Council shall be elected a President, Treasurer, and two Secretaries in the same Way.

The President shall preside in all Meetings, regulate all Debates of the Society and Council; State, and put Questions; call for Reports and Accounts from Committees, Curators, and others; summon all extraordinary Meetings upon urgent Occasions, and see to the Execution of the Statutes. The Vice-President shall have the same Power in the Absence of the President.

The Treasurer, or his Deputy, shall receive and keep Accounts of all Money due to the Society, and disburse all Money payable by the Society. He shall pay small Sums by Order of the President under his Hand, but those that exceed five Pounds by Order of the Council. All Bills of Charges for Experiments shall first be signed by the Curators. The Accounts of the Treasurer shall be audited four times a Year, by a Committee of the Council, and once a Year by a Committee of the Society.

The Secretaries are to take Notes of the Orders, and material Passages of the Meetings; to take care of the Books, Papers, and Writings of the Society; to order, and direct the Clerks in making Entries of all Matters in the Register and Journal Books of the Society or Council; to draw up such Letters as shall be written in their Name, which shall be approved at one of their Meetings; to give notice of the Candidates propounded in order to Election.

The Curators by Office shall have a sufficient Allowance for their Encouragement, which shall increase proportionably with the Revenue of the Society, provided

vided that it exceed not two hundred Pounds a Year. They shall be well skilled in philosophical and mathematical Learning, well vers'd in Observations, Inquiries, and Experiments of Nature and Art. They shall take care of the managing of all Experiments and Observations appointed by the Society or Council, and report the same, and perform such other Tasks, as the Society or Council shall appoint; such as the examining of Sciences, Arts, and Inventions now in use, and the bringing in Histories of natural and artificial Things, &c. They shall be propounded at least a Month before they are chosen. They shall be examined by the Council before the Election: To their Election every Member of the Society shall be summoned: They shall at first be only elected for a Year of Probation, except they be of known Merits; at the end of the Year, they shall be either elected for Perpetuity, or for a longer Time of Probation, or wholly rejected. The Causes of ejecting a Curator shall be the same with ejecting a Fellow, or for fraudulent Dealing and Negligence in the Affairs of the Society, provided that he shall first receive three respective Admonitions. If any Curator shall be disabled by Age, Infirmary, or any Casualty, in the Service of the Society, some Provision shall be made for him during Life, if his Condition requires, according as the Council shall think fit.

The Clerk shall constantly attend at all Meetings; he shall follow the Directions of the Secretaries, in registering and entering all Matters that shall be appointed: he shall not communicate any thing contained in their Books, to any that is not a Fellow. He shall have a certain Rate for what he copies, and a yearly Stipend for his Attendance.

The Printer shall take care for the printing of such
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Books

The HISTORY of

Books as shall be committed to him by Order of the Society, or Council; and therein he shall observe their Directions, as to the Correction of the Edition, the Number of Copies, the Form, or Volume, &c.

The Operators of the Society, when they have any of their Work under their Hands, shall not undertake the Work of any other Persons, which may hinder the Business of the Society: They shall have Salaries for their Attendance.

The common Seal of the Society shall be kept in a Chest with three Locks, and three different Keys, by the President, Treasurer, and one of the Secretaries. The Deeds of the Society shall be pass'd in Council, and seal'd by them and the President.

The Books that concern the Affairs of the Society, shall be the Charter Book, Statute Book, Journal Books, Letter Books, and Register Books, for the entring of philosophical Observations, Histories, Discourses, Experiments, Inventions.

The Names of Benefactors shall be honourably mentioned in a Book provided for that purpose.

In case of Death, or Recess of any Fellow, the Secretaries are to note it in the Margin of the Register, over against their Names.

The Causes of Ejection shall be contemptuous Disobedience to the Statutes and Orders of the Society; defaming or malicious damnifying the same. This shall be declared by the President at one of the Meetings; and the Ejection recorded.

When these Statutes were presented to his Majesty, he was pleas'd to superscribe himself their Founder and Patron; his Royal Highness, and his Highness Prince Rupert, at the same time, declaring themselves Fellows.

Nor

Nor has the *King* only encourag'd them, by Kind-^{Sect. XXVII.}
 nefs and *Words*, and by *Acts of State*; but he has also ^{The King's}
 provok'd them to unwearied Activity in their *Expe-*^{Example in}
riments, by the most effectual Means of his *Royal Ex-*^{promoting}
ample. There is scarce any one sort of *Work*, whose Ad-^{Experiments.}
 vancement they regard; but from his *Majesty's* own
 Labours they have receiv'd a *Pattern* for their Indea-
 vours about it. They design the multiplying and
 beautifying of *Mechanick Arts*: And the Noise of
Mechanick Instruments is heard in *Whitehall* itself.
 They intend the Perfection of *Graving, Statuary,*
Limning, Coining, and all the Works of Smiths, in Iron,
 or Steel, or Silver: And the most excellent *Artists* of
 these kinds have Provision made for their Practice,
 even in the Chambers and Galleries of his *Court*.
 They purpose the Trial of all manner of *Operations by*
Fire; And the *King* has under his own Roof found
 place for *Chymical Operators*. They resolve to restore,
 to enlarge, to examine *Physick*; and the *King* has in-
 dow'd the College of *London* with new Privileges,
 and has planted a *Physick Garden* under his own Eye.
 They have bestow'd much Consideration on the *pro-*
pagating of Fruits and Trees: And the *King* has made
Plantations enough, even almost to repair the Ruins
 of a Civil War. They have begun an exact *Survey*
 of the *Heavens*; and *St. James's Park* may witness,
 that *Ptolomy* and *Alphonso* were not the only *Mo-*
narchs, who observ'd the Motions and Appearances of
 the *Stars*. They have studied the promoting of *Ar-*
chitecture in our Island; and the Beauty of our late
Buildings, and the Reformation of his own Houses, do
 sufficiently manifest his Skill and Inclination to that
Art: of which Magnificence, we had seen more Ef-
 fects.

fects e'er this, if they had not been call'd off by this War, from Houses of *Convenience*, to those of *Strength*. They have principally consulted the Advancement of *Navigation*; and the *King* has been most ready to reward those, that shall discover the *Meridian*. They have employ'd much Time in examining *the Fabrick of Ships*, the Forms of their *Sails*, the Shapes of their *Keels*, the Sorts of Timber, the planting of Fir, the bettering of Pitch, and Tar, and Tackling. And in all *maritime* Affairs of this Nature, his *Majesty* is acknowledg'd to be the best *Judge* amongst Seamen and Shipwrights, as well as the most powerful amongst *Princes*.

Sect. XXVIII.
And the pre-
sent Genius
of our Nation.

By these and many other Instances it appears, that the *King* has not only given Succour to the *Royal Society*, in the prosecution of their *Labours*; but has also led them on their *Way*, and trac'd out to them the Paths, in which they ought to tread. And with this propitious Inclination of his *Majesty*, and the highest *Degrees* of Men, the *Genius* of the *Nation* itself irresistibly conspires. If we reflect on all the past Times of *Learning* in our *Island*; we may still observe some remarkable *Accidents*, that retarded these *Studies*, which were still ready to break forth, in spite of all Opposition.

Till the Union of the two Houses of *York* and *Lancaster*, the whole Force of our *Country* was engag'd in Domestick Wars, between the *King* and the *Nobility*, or in the furious Contentions between the divided Families: unless sometimes some magnanimous *Prince* was able to turn their Strength to foreign Conquests. In King *Henry the Seventh* the two *Roses* were join'd: His Government was like his own
Temper,

Temper, *close, severe, jealous, avaritious*, and withal *victorious*, and *prudent* : but how unprepar'd his Time was for new Discoveries, is evident by the slender Account that he made of the Proposition of *Columbus*. The Reign of King *Henry the Eighth* was *vigorous, haughty, magnificent, expensive, learned* : But then the Alteration of *Religion* began, and that alone was then sufficient to possess the Minds of Men.

The *Government* of King *Edward the Sixth* was contentious, by reason of the Factions of those who manag'd his Childhood ; and the Shortness of his Life depriv'd us of the Fruits, that might have been expected from the prodigious Beginnings of the *King* himself. That of *Queen Mary* was *weak, melancholy, bloody* against the Protestants, obscur'd by a foreign Marriage, and unfortunate by the Loss of *Calais*. That of *Queen Elizabeth* was *long, triumphant, peaceable* at home, and *glorious* abroad. Then it was shewn, to what height the *English* may rise, when they are commanded by a *Prince*, who knows how to govern their Hearts as well as Hands. In her Days the *Reformation* was settled, Commerce was establish'd, and *Navigati-on* advanc'd. But though Knowledge began abundantly to spring forth, yet it was not then seasonable for *Experiments* to receive a *publick Incouragement* : while the Writings of Antiquity, and the Controversies between us and the Church of *Rome*, were not fully study'd and dispatch'd.

The *Reign* of King *James* was happy in all the Benefits of *Peace*, and plentifully furnish'd with Men of profound *Learning* : But in Imitation of the *King*, they chiefly regarded the Matters of *Religion* and *Disputation* ; so that even my Lord *Bacon*, with all his Authority in the State, could never raise any College
of

of *Salomon*, but in a *Romance*. That of *King Charles* the first began indeed to be ripe for such Undertakings, by reason of the Plenty and Felicity of the first Years of his *Government*, and the Abilities of the *King* himself; who was not only an inimitable *Master*, in *Reason* and *Eloquence*, but excell'd in very many practical *Arts*, beyond the usual Custom of *Kings*, nay even beyond the Skill of the best *Artists* themselves. But he, alas! was call'd away from the Studies of *Quiet* and *Peace*, to a more dangerous and a more honourable Reputation. The chief Triumphs that Heav'n reserv'd for him, were to be gather'd from his *suffering Virtues*: In them he was only exceeded by the Divine Example of our *Saviour*; in Imitation of whose Passion, those Afflictions, and those Thorns which the rude Soldiers design'd for his *Disgrace* and *Torment*, became his *Glory* and his *Crown*.

The late Times of *Civil War* and *Confusion*, to make Recompence for their infinite Calamities, brought this Advantage with them, that they stir'd up Men's Minds from *long Ease*, and a *lazy Rest*, and made them *active*, *industrious* and *inquisitive*: it being the usual Benefit that follows upon *Tempests* and *Thunders* in the *State*, as well as in the *Sky*, that they purifie and clear the *Air*, which they disturb. But now since the *King's* Return, the Blindness of the former *Ages*, and the Miseries of this last, are vanish'd away: now Men are generally weary of the *Relicks* of *Antiquity*, and satiated with *Religious Disputes*: now not only the *Eyes* of Men, but their *Hands* are open and prepar'd to labour: Now there is an universal *Desire* and *Appetite* after *Knowledge*, after the peaceable, the fruitful, the nourishing *Knowledge*, and not after that of antient Sects, which only yielded hard indigestible *Arguments*,

or sharp *Contentions* instead of *Food* ; which when the Minds of Men requir'd *Bread*, gave them only a *Stone*, and for a *Fish* a *Serpent*.

Whatever they have hitherto attempted, on these Principles and Incouragements, it has been carry'd on with a vigorous Spirit, and wonderful good Fortune, from their first Constitution down to this Day. Yet I overhear the Whispers and Doubts of many, who demand, what they have done all this while? And what they have produc'd, that is answerable to these mighty Hopes, which we endeavour to make the World conceive of their Undertaking?

Sect. XXIX.
The Subjects
about which
they have
been employ'd.

If those who require this Account, have themselves perform'd any worthy Things, in this Space of Time ; it is fit, that we should give them Satisfaction. But they who have done nothing at all, have no reason to upbraid the *Royal Society*, for not having done as much as they fancy it might. To those therefore who excite it to work by their Examples, as well as Words and Reproofs, methinks it were a sufficient Answer, if I should only repeat the particulars I have already mention'd, wherein the *King* has set on foot a *Reformation*, in the Ornaments, and Advantages of our Country. For though the original Praise of all this is to be ascrib'd to the Genius of the *King* himself ; yet it is but just, that some Honour should thence descend to this Assembly, whose Purposes are conformable to his Majesty's Performance of that Nature : Seeing all the little Scandals, that captious Humours have taken against the *Royal Society*, have not risen from their general Proceedings, but from a few pretended Offences of some of their private Members ; it is but reason, that we should alledge in their

Commendation, all the excellent Designs, which are begun by the *King*, who has not only styl'd himself their *Founder*, but acted as a particular *Member* of their Company.

To this I will also add, that in this Time, they have pass'd through the first Difficulties of their *Charter* and Model; and have overcome all Oppositions, which are wont to arise, against the Beginnings of great Things. This certainly alone were enough to free them from all Imputation of Idleness, that they have fram'd such an Assembly in six Years, which was never yet brought about in six thousand. Besides this the World is to consider, that if any shall think, the whole Compass of their Work might have come to a sudden Issue; they seem neither to understand the Intentions of the *Royal Society*, nor the Extent of their Task. It was never their Aim, to make a violent Dispatch. They know, that Precipitancy in such Matters was the Fault of the Antients: And they have no Mind, to fall into the same Error, which they endeavour to correct. They began at first on so large a Bottom, that it is impossible, the whole Frame should be suddenly completed. 'Tis true, they that have nothing else to do, but to express, and adorn Conclusions of Knowledge already made, may bring their Arts to an End, as soon as they please: But they who follow the slow and intricate Method of Nature, cannot have the Seasons of their Productions, so much in their own Power. If we would always exact from them daily or weekly Harvests; we should wholly cut off the Occasions of very many excellent Inventions, whose Subjects are remote, and come but seldom under their Consideration. If we would require them, immediately to reduce all their Labours, to publick and conspicuous

ous Use ; by this dangerous Speed, we should draw them off from many of the best Foundations of Knowledge. Many of their noblest Discoveries, and such as will hereafter prove most serviceable, cannot instantly be made to turn to Profit. Many of their weightiest and most precious *Observations*, are not always fit to be exposed to open View : For it is with the greatest Philosophers, as with the richest Merchants, whose Wares of greatest Bulk and Price, lye commonly out of Sight, in their Warehouses, and not in their Shops.

This being premis'd, I will however venture to lay down a brief Draught of their most remarkable Particulars ; which may be reduced to these following Heads : The Queries and Directions they have given abroad ; the Proposals and Recommendations they have made ; the Relations they have received ; the Experiments they have tried ; the Observations they have taken ; the Instruments they have invented ; the Theories that have been proposed ; the Discourses they have written, or published ; the Repository and Library ; and the Histories of Nature, and Arts, and Works they have collected.

Their Manner of gathering, and dispersing *Queries*, is this. First, they require some of their particular Fellows, to examine all Treatises and Descriptions of the Natural and Artificial Productions of those Countries, in which they would be informed. At the same Time, they employ others to discourse with the Seamen, Travellers, Tradesmen, and Merchants, who are likely to give them the best Light. Out of this united Intelligence from Men and Books, they compose a Body of Questions, concerning all

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the observable Things of those Places. These Papers being produced in their weekly Assemblies, are augmented, or contracted, as they see Occasion. And then the Fellows themselves are wont to undertake their Distribution into all Quarters, according as they have the Convenience of Correspondence: Of this Kind I will here reckon up some of the principal, whose particular Heads are free to all that shall desire Copies of them for their Direction.

They have composed Queries, and Directions; what Things are needful to be observed, in order to the making of a natural History in general; what are to be taken Notice of towards a perfect History of the Air, and Atmosphere, and Weather; what is to be observed in the Production, Growth, Advancing or Transforming of Vegetables; what Particulars are requisite, for collecting a compleat History of the Agriculture, which is used in several Parts of this Nation.

They have prescribed exact Inquiries, and given punctual Advice for the Trial of Experiments of Rarefaction, Refraction, and Condensation; concerning the Cause and Manner of the Petrification of Wood; of the Loadstone; of the Parts of Anatomy, that are yet imperfect; of Injections into the Blood of Animals; and transfusing the Blood of one Animal into another; of Currents; of the ebbing and flowing of the Sea; of the Kinds, and Manner of the feeding of Oysters; of the Wonders, and Curiosities observable in deep Mines.

They have collected, and sent abroad Inquiries for the *East-Indies*, for *China*, for *St. Helena*, for *Teneriff*, or any high Mountain, for *Guinea*, for *Barbary*,

ary, and *Morocco*, for *Spain*, and *Portugal*, for *Turky*, for *France*, for *Italy*, for *Germany*, for *Hungary*, for *Transylvania*, for *Poland*, and *Sweden*, for *Iceland*, and *Greenland*, they have given Directions for Seamen in general, and for observing the Eclipses of the Moon; for observing the Eclipses of the Sun by *Mercury*, in several Parts of the World, and for observing the *Satellites* of *Jupiter*:

Of this their Way of Inquiry, and giving Rules for Direction, I will here produce a few Instances; from whose Exactness it may be guessed, how all the rest are performed.

The HISTORY of
A N S W E R S
 RETURN'D BY
SIR PHILBERTO VERNATTI

Resident in *Batavia* in *Java Major*,

To certain Inquiries sent thither by Order of the
Royal Society, and recommended by

SIR ROBERT MORAY.

Q. 1. *Whether Diamonds and other precious Stones grow again, after three or four Tears, in the same Places where they have been digged out?*

A. Never, or at least as the Memory of Man can attain to.

Q. 2. *Whether the Quarries of Stone in India, near Fetipoca, not far from Agra, may be cleft like Logs, and sawn like Planks, to ceil Chambers, and cover Houses.*

A. What they are about the Place mentioned, I have not as yet been well inform'd; but in *Persia* not far from *Cyrus* where the best Wine groweth, there is a sort of hard Stone which may be cleft like Firwood, as if it had a Grain in it; the same is at the Coast *Cormandel* about *Sadraspatuam*; where they make but a mark in the Stone, set a Wedge upon it, with a wooden Hammer, as thick and thin as they please; it is used commonly for Pavement in Houses, one Foot square, and so cheap, that such a Stone finely polish'd costs not above six Pence.

Q. 3. *Whether there be a Hill in Sumatra, which burneth continually, and a Fountain which runneth pure Balsam ?*

A. There is a Hill that burneth in *Sumatra* near *Endrapeor*; but I cannot hear of any such Fountain; and I believe that the like Hill is upon *Java Major* opposite to *Batavia*; for in a clear Morning or Evening, from the Road a Man may perfectly perceive a continual Smoak rise from the top, and vanish by little and little. I have often felt Earthquakes here, but they do not continue long. In the Year 1656, or 57, (I do not remember well the Time) *Batavia* was cover'd in one Afternoon, about two of the Clock, with a black Dust, which being gather'd together, was so ponderous, that it exceeded the Weight in Gold. I, at that Time, being very ill, did not take much Notice of it, but some have gathered it, and if I light upon it, I shall send you some. It is here thought, it came out of the Hill: I never heard of any that had been upon this Hill's top. *Endrapeor* is counted a mighty unwholesome Place, as likewise all others where Pepper grows; as *Jamby*, *Banjar*, *Balingtoan*, &c. though some impute it to the Hill's burning.

As for the Fountain, it is unknown to us, except *Oleum Terræ* is meant by it, which is to be had in *Sumatra*, but the best comes from *Pegu*.

Q. 4. *What River is that in Java Major that turns Wood into Stone ?*

A. There is none such to our Knowledge; yet I have seen a Piece of Wood with a Stone at the End of it; which was told me, that was turned into Stone by a River in *Pegu*; but I took it but for a Foppery; for divers *Arbusta* grow in Rocks, which being appropriated

priated curiously, may easily deceive a too hasty Believer.

Q. 5. *Whether it be true, that upon the Coast of Achin in Sumatra, the Sea, though it be calm, groweth very high when no Rain falls, but is smooth in Rain, though it blows hard?*

A. Sometimes, but not always; the Reason is this, that *Achin* lyeth at the very End and Corner of *Sumatra*, as may be seen by the Map, open in the main Ocean, so that the Sea comes rowling from the *Cabo de bona Esperanza*, and all that way unto it, and it is natural to the Sea to have a continual Motion, let it be ever so calm; which Motion cannot be called a Wave, neither have I any *English* for it at present, but in *Dutch* we call it, *Deyninge van Dee Zee*, and the calmer it is, the higher; the natural Motion of the Sea elevates very slowly the Water; so that I have seen Ships and Junks tossed by these *Deynings* in a calm, (when there is scarce Wind enough to drive a Bubble) that a Man can scarce stand in them; some say this Motion proceeds from boisterous Winds at Sea far distant. That Rain beats down the swelling of these *Deynings* (especially if it be vehement) proceeds naturally from its Weight and Impetuosity. And it is observed, that about *Achin* the Mountains are high and steep, from whose Tops boisterous Winds, called *Travant*, come suddenly (like a Granado-cast) falling into the Sea, are accompanied commonly with a great Shower of Rain, and last not above a Quarter, or at the most, half an Hour, which is too short a Time to disturb the Sea, or to cause a contrary Motion in it, being shelter'd by these Mountains.

Q. 6. *Whether in the Island of Sambrero, which lyeth Northwards of Sumatra, about eight Degrees Northern*

thern Latitude, there be found such a Vegetable as Mr. James Lancaster relates to have seen, which grows up to a Tree, shrinks down, when one offers to pluck it up, into the Ground, and would quite shrink, unless held very hard? And whether the same, being forcibly pluck'd up, hath a Worm for its Root, diminishing more and more, according as the Tree groweth in Greatness; and as soon as the Worm is wholly turned into the Tree, rooting in the Ground, and so growing great? And whether the same plucked up young turns, by that time it is dry, into a hard Stone, much like to white Corral?

A. I cannot meet with any that ever have heard of such a Vegetable.

Q. 7. Whether those Creatures that are in these Parts plump, and in Season at the full Moon, are lean and out of Season at the new, and the contrary, at the East-Indies?

A. I find it so here, by Experience at Batavia, in Oysters and Crabs.

Q. 8. What ground there might be for that Relation, concerning Horns taking Root, and growing about Goa?

A. Inquiring about this, a Friend laugh'd, and told me it was a Jeer put upon the Portuguese, because the Women of Goa are counted much given to Lechery.

Q. 9. Whether the Indians can so prepare that stupefying Herb *Datura*, that they make it lye several Days, Months, Years, according as they will have it, in a Man's Body, without doing him any hurt, and at the end kill him, without missing half an Hour's time?

A. The China Men in this Place have formerly used *Datura* as a Fermentation, to a sort of Drink much beloved by the Soldiers and Mariners, called *Suyker-*
X
bier,

bier, which makes them raging mad, so that it is forbidden strictly under the Penalty of a great Pain to make use of the same.

Q. 10. *Whether those that be stupified by the Juice of this Herb Datura, are recovered by moistning the Soles of their Feet in fair Water?*

A. No. For I have seen diverse Soldiers and Mariners fall into the Rivers and Ditches, being stupified by their Drink aforesaid, who were rather worse after they were taken out, than better.

Q. 11. *Whether a Betel hath such a Contrariety to the Durion, that a few Leaves thereof put to a whole Shopful of Durions, will make them all rot suddenly? And whether those who have surfeited on Durions, and thereby overheated themselves, do by laying one Leaf of Betel cold upon the Heart, immediately cure the Inflammations and recover the Stomach? This Betel being thought to preserve those Indians from Tooth-ach, loose Gums and Scurvy, and from stinking Breath; some of it is desired to be sent over with the Fruit Arcica, and the other Ingredients, and Manner of preparing it.*

A. I have seen that *Betel* Leaves in a short time will spoil a *Durion*, take away its Nature, and turn a fat creamy Substance into Water. Commonly those that eat great Quantities of *Durions*, eat a *Betel* afterwards as a *Correctorium*; but of laying a Leaf upon the Heart, I have never heard. As for the other Qualities of the *Betel*, I believe they are good, if not abused; as most of the *Indians* do, who never are without it in their Mouths, no not sleeping, which corrodes their Teeth, and makes them as black as Jet: It draws from the Head the phlegmatick Humours, which are voided by spitting; so we use it;

but

but the *Indians* swallow down their Spittle, together with the Juice of the *Betel*, and the *Areica*. The Manner of preparing it is easy, being nothing but the *Nut*, *Leaf* and *Calx viva*, of which last each one adds as much as pleaseth his Palate. There is a Sort of Fruit called *Singboa*, which is used with the *Areica*, instead of *Betel*, and can be dried and transported as well as the *Areica*, and hath the same Force, but a great deal more pleasant to the Palate.

Q. 12. *Whether the Papayas, that beareth Fruit like a Melon, do not grow, much less bear Fruit, unless Male and Female be together?*

A. They grow, as I have seen two in the *English* House at *Bantam*, and bear little Fruit, which never comes to Perfection; but if the Male and Female be together, the one bears great Fruit, the other nothing but Flowers.

Q. 13. *Whether the Arbor Triste sheds its Flowers at the rising of the Sun, and shoots them again at the setting of the Sun? And whether the distill'd Water thereof (call'd Aqua di Mogli by the Portugals) may not be transported to England? And whether at the rising of the Sun the Leaves of the Arbor Triste drop off as well as the Flowers?*

A. There are two sorts of the *Arbor Triste*; one is called by the *Portugals* *Triste de Die*, the other *Triste de Nocte*; the one sheds its Flowers at the rising, the other at the setting of the Sun; but neither of them shed their Leaves. There is no Body here that understands the distilling of Waters; some say this *Aqua di Mogli* is to be had at *Malaca*, for which I have writ, and shall send it if procurable.

Q. 14. *Whether the Arbor de Rays, or Tree of Root, propagate itself in a whole Forest, by shooting up and letting*

letting fall Roots from its Branches into the Ground, that spring up again, and soon?

A. This is true. And we have diverse Trees about *Batavia*, and the like adjacent Islands, above fifty Foot in the Diameter.

Q. 15. What kind of Fruit is that in Jucca, which grows immediately out of the Trees's Body; and is said to breed the Plague if eaten immoderately?

A. It is a Fruit much like to *Durion*, which groweth in the same Manner; hath a faint Smell, and sweet waterish Taste; for my part I do not affect them: The *Plague* is a Disease unknown amongst the *Indians*; but this Fruit, as most others do, immoderately eaten, causes a *Diarhea*, which easily degenerates to a *Tenesmus*, by us called *Peirsing*, a dangerous Sickness, and worse than the *Plague*.

Q. 16. What Poison is it the King of Macassar in Colebees is said to have particular to himself, which not only kills a Man immediately, that hath received the slightest Wound by a Dart dipt therein, but also within half an Hour's time, makes the Flesh, touched with it, so rotten, that it will fall like Snivel from the Bones, and whose poysonous Steam will soon fly up to a Wound made with an unpoisoned Dart, if the Blood be only in the slightest Manner touch'd with a Dart infected with the Poison? What Certainty there is of this Relation?

A. That there is such a Poison in this King's Possession is most certain; but what it is, no *Christian* hitherto ever knew right. By the Government of *Arnold de Flamminge Van Outshorn* diverse have been tortured; yea, killed.

Some say it is the Gall of a venomous Fish, others say it is a Tree which is so venomous, that those who

are

are condemned to die, fetch the Poison; but not one of an Hundred escapes Death; the Roots of this Tree are held an Antidote against the Poison; but our People, when we had War with *Macassar*, found no Antidote like to their own or other's Excrements; as soon as they felt themselves wounded, they instantly took a Dose of this same, which presently provoked to vomit, and so, by Repulsion, (as I perceive) and Sweat, freed the noble Parts from farther Infection. That a Wound should be infected by this Poison, tho' not inflicted by an impoisoned Weapon, is not strange to those who study Sympathy; and set Belief in that much renowned sympathetical Powder of Sir *Kennel Digby*. Yet such Effects of the *Macassars* Arts are unknown to us.

Q. 17. *Whether in Pegu and other Places in the East-Indies, they use a Poison that kills by smelling, and yet the Poison-Smell is hardly perceived?*

To this no Answer was return'd.

Q. 18. *Whether Camphire comes from Trees? What kind of Trees they are in Borneo, that are said to yield such excellent Camphire, as that one Pound thereof is said to be worth an Hundred of that of China and other Places?*

A. *Camphire* comes from Trees of an excessive Bulk, as you may see by the Chests which come from *Japan* into *Europe*, made of the same Wood of *Borneo*; it comes likewise from Trees, which are said to stand in sandy Ground, and drop like a Gum.

But of late an Experiment is found in *Ceylon*, that the Root of a Cinnamon Tree yields as good *Camphire*, as either *Japan*, or *China*, of which I shall send you a Pattern, being now to be had at present here; as also an Oil extracted from the same Roots, which reserves

reserves something of the Cinnamon-smell ; but that may be the Fault of the Distiller.

Q. 19. Whether some of that rare Wood, call'd Palo d'Aquila and Calamba, of an extraordinary Value, even in the Country where it groweth, as in Siam about San, and Patan, and in Cochinchina, may not be brought over ; as also some of those strange Nests of Cochinchina, made by Birds upon Rocks, of a certain viscus Froth of the Sea, which Nests grown dry and hard, are said to become transparent ; and when dissolved in Water, serve excellently to season all their Meats ?

A. If the Question be made, whether these Things may be brought over by Permission of the Company ? I answer ; as first, that their Laws forbid the Transportation of all whatsoever, whether necessary to the Conservation of Health, or Acquisition of Wealth, or Rarities, &c. but if the *Query* be concerning the Nature and Substance of the Wood and Nests ; they are transportable, and can subsist without decaying many Years. *Lignum Aquila* is far inferior to *Calamba*, though not easy to be discerned. A Pound of *Calamba* is worth in *Japan* thirty, and sometimes forty Pounds Sterling ; the best comes from *Cambodia*, and seems to be the Pith of the Tree *Aquila* in *Japan* ; it is used as Incense to perfume Clothes, and Chambers. It is held for a great Cordial, and commonly us'd by that Nation, as also the *Chinese*, in *Defectione spirituum vitalium* ; as in *Paralysi & Nervorum laxatione & impotentia* : They rub it with *Aqua Cynamomi* upon a Stone, till the Substance of the Wood is mixt, *sicut pulpa*, with the Water, and so drink it with Wine, or what they please. The Bird's Nests are a great Restorative to Nature, and much used by the lecherous *Chinese*.

Q. 20. *Whether the Animal call'd Abados, or Rhinoceros, hath Teeth, Claws, Flesh, Blood, and Skin, yea his very Dung and Water, as well as his Horns, antidotal? And whether the Horns of those Beasts be better or worse, according to the Food they live upon.*

A. Their Horns, Teeth, Claws, and Blood are esteemed Antidotes, and have the same Use in the *Indian Pharmacopeia* as the *Theriaca* hath in ours; the Flesh I have eaten is very sweet and short. Some Days before the Receipt of your Letter, I had a young one no bigger than a Spaniel Dog, which followed me wherever I went, drinking nothing but *Buffalo* Milk, lived about three Weeks, then his Teeth began to grow, and he got a Looseness and died. 'Tis observed, that Children (especially of *European* Parents) at the breaking out of their Teeth are dangerously sick, and commonly die of the scouring in these Parts. His Skin I have caused to be dried, and so present it unto you, since Fate permits not to send him you living; such a young one was never seen before. The Food I believe is all one to this Animal, being that they are seldom seen but amongst withered Branches, Thistles and Thorns; so that the Horn is of equal Virtue.

Q. 21. *Whether the falsifying of the China Musk is not rather done by mixing Oxen and Cow's Livers dried and pulverised with some of the putrified and concrete Flesh and Blood of the China Musk-cat, than by beating together the bare Flesh and Blood of this Animal, &c.*

Nor answer'd.

Q. 22. *Whether there be two Sorts of Gumlac, one produced from a certain winged Ant; the other the Exudation of a Tree; the first had in the Islands*
of

of Suachan, the last in the Kingdom of Martaban ?

A. We know of none but such as drop from Trees, and come from diverse Places in *Siam, Cambodia, Pegu, &c.*

Q. 23. *If the best Ambergrease be found in the Islands Socotora and Aniana, near Java ? To endeavour the getting of more certain Knowledge, what it is ; being reported to be bred in the Bottom of the Sea like to a thick Mud ?*

A. The best that is in the World comes from the Island *Mauritius* : and is commonly found after a Storm. The Hogs can smell it at a great Distance ; who run like mad to it, and devour it commonly before the People come to it. It is held to be a *Zeequal* Viscosity, which being dried by the Sun, turns to such a Consistence as is daily seen. Father *Myavimes Isaac Vigny* a French Man in *Oleron*, hath been a great Traveller in his Time ; and he told me, he sailed once in his Youth through so many of these *Zeequalen*, as would have loaden ten thousand Ships ; the like having been never seen : His Curiosity did drive him to take up some of those, which being dried in the Sun, were perceived to be the best *Ambergrease* in the World. I have seen one Piece which he kept for a *Memento*, and another Piece he sold for a 1300 *lib. sterl.* This being discovered, they set sail to the same Place where these *Zeequalen* appeared, and cruised there, to and fro, for the space of six Weeks, but could not perceive any more. Where this Place is situated, I do not know ; but Monsieur *Gentillot*, a French Captain in *Holland*, can tell you.

Q. 24. *To enquire of the Divers for Pearls staying long under Water, whether they do it by the assistance of*

any thing they carry with them, or by long and often Use get a Trick of holding their Breath so long, at the Isle of Bahaaen near Ormus?

A. What they do at *Baharen* is unknown to me, but since we have had *Tute Corein* in *Ceylon*, where very good Pearls grow, I hear the *Divers* use no Artifice. The manner is thus; at a set time of the Year Merchants come from all Parts, as likewise *Divers* with their Boats; each Boat hath a certain Quantity of square Stones, upon which Stones the *Divers* go down, and give a Token to their Companions, when they think it time to be hal'd up; each Stone pays Tribute to the Company. The Oyster or Shell-Fish is not immediately open'd, but laid on Heaps, or in Holes at the Sea-side. When the diving Time is ended, the Merchants come and buy these Heaps, according as they can agree, not knowing whether they shall get any thing or no. So that this is a meer Lottery. This Pearl-fishing is dangerous, being the *Divers* commonly make their Will, and take Leave of their Friends, before they tread the Stone to go down.

Q. 25. Whether Cinnamon when first gathered hath no Taste at all, but acquires its Taste and Strength by fifteen Days sunning? And whether the Bark be gathered every two Years in the Isle of Ceylon?

A. The Cinnamon Tree as it groweth is so fragrant, that it may be smelt a great Way off before it be seen. And hath even then, a most excellent Taste; so that by sunning it loseth rather than acquires any Taste or Force; the Tree being pill'd is cut down to the Root; but the young Sprigs after a Year or two give the best and finest Cinnamon.

Q. 26. To learn, if it may be, what Art the Master-workmen of Pegu have to add to the Colour of their Rubies?

Y

A. Not

A. Not answered.

Q. 27. To inquire after, and get, if possible, some of the Bones of the Fish called Caballa, which are so powerful in stopping Blood.

A. 'Tis done, and they shall follow with the Dutch Ships.

Q. 28. Whether at Hernita, a Town in Ethiopia, there are Tortoises so big, that Men may ride upon them ?

A. It is reported, that there be extraordinary great ones there ; I have seen some Sea Tortoises here, of four Foot broad, in oval Form, very low leg'd, but of that Strength, that a Man may stand on one : The manner of catching them, is to turn them with a Fork upon their Backs.

Q. 29. Whether there be a Tree in Mexico, that yields Water, Wine, Vinegar, Oil, Milk, Honey, Wax, Thread and Needles ?

A. The *Cokos* Tree yields all this and more ; the Nut, while it is green, hath very good Water in it ; the Flower being cut, drops out great Quantity of Liquor, called *Sury*, or *Teywack*, which drank fresh, hath the Force, and almost the Taste of Wine ; grown four, is very good Vinegar ; and distilled, makes very good Brandy, or *Areck* : The Nut grated, and mingled with Water, tasteth like Milk ; pressed, yields very good Oil : Bees swarm in these Trees, as well as in others ; Thread and Needles are made of the Leaves and tough Twigs. Nay, to add something to this Description ; in *Amboyna*, they make Bread of the Body of the Tree, the Leaves serve to thatch Houses, and likewise sails for their Boats.

Q. 30. Whether about Java, there be Oysters of that vast Bigness, as to weigh three hundred Weight ?

A.

A. I have seen a Shell Fish, but nothing like an Oyster, of such a Bigness, the Fish being salted, and kept in pickle, afterwards boiled, tasteth like Brawn in England, and is of an horny Substance.

Q. 31. Whether near Malacca, there be found in the Gall of certain Swine, a Stone esteemed incomparably above Bezoar?

A. In that Country, but very seldom, there grows a Stone in the Stomach of a *Porkapine*, called *Pedro Porco*; of whose Virtue there are large Descriptions; and the *Hollanders* are now so fond, that I have seen 400 Dollars of $\frac{2}{3}$ given for one no bigger than a Pigeon's Egg. There is Sophistication as well in that as *Bezoar*, *Musk*, &c. and every Day new Falshood, so that I cannot well set down here any Rules, but must be judged by Experience. A false one I send you, which doth imitate very near in Virtue the true one, but is a great deal bigger; and of another Colour.

As for the Observations desired of the Islands *St. Helena*, and *Ascension*, they may be better made by the *English East-India* Men, who commonly touch at both Places; but the *Hollanders* never, or very seldom.

Q. 32. Whether it be Winter at the East-side of the Mountain Gates, which come from the North to Cape Comoryn, whilst it is Summer on the West-side? and Vice versa.

A. Not only there, but likewise on the Island of *Zeylon*.

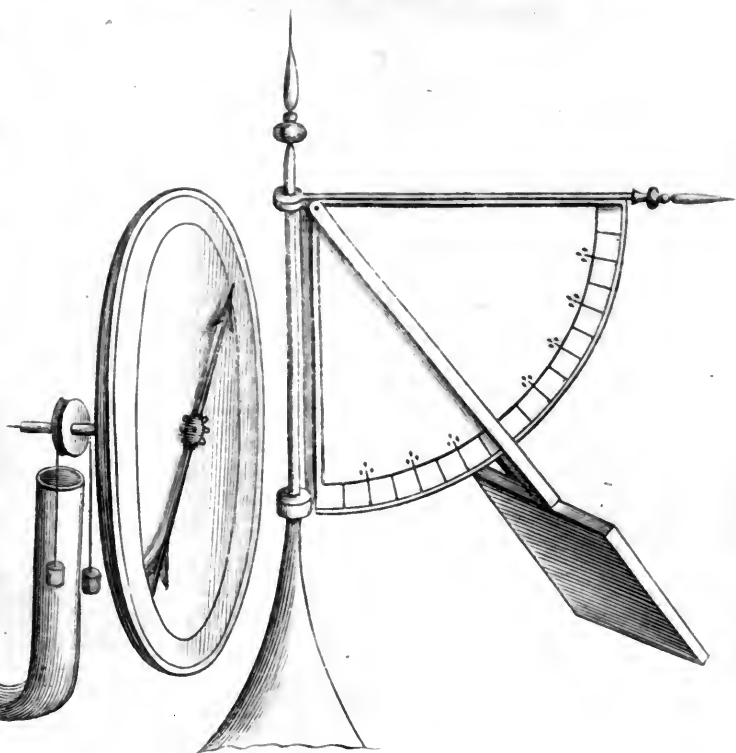
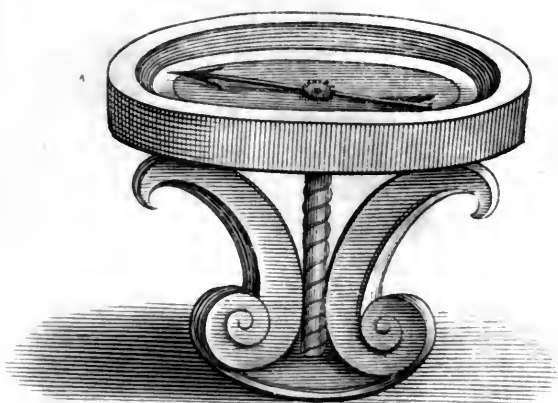
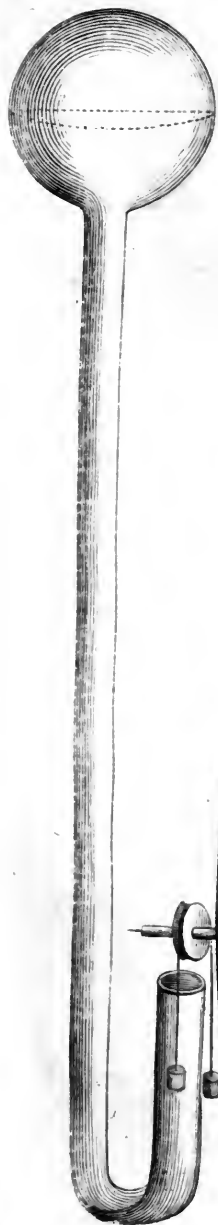
Q. 33. In what Country Lignum Aloes is found, whether it be the Wood of a Tree? or the Root of a Tree? How to know the best of the Kind?

A. *Lignum Aloes*, *Lignum Paradisi*, *Calamba*, are *Synonyma*, the same: and the same Wood comes most

from *Cambodia*, and *Siam*; but they say it is brought by the People of *Lawlan*, a Country about *Cambodia*, whence *Musk*, and *Benzoin*, and most *Aromata* come; it is easily distinguished from other Wood by its strong Scent and Richness of Balm in it, which appears in its Blackness; it is of great Value, and hard to be gotten here.

The rest of the *Queries* are not answered, because the Time is short since I received them, and especially, because I cannot meet with any one that can satisfy me, and being unsatisfied my self, I cannot nor will obtrude any Thing upon you, which may hereafter prove fabulous, but shall still serve you with Truth.





A

M E T H O D

For making a History of the WEATHER.

By Mr. *H O O K*.

“ **F**OR the better making a History of the Weather, I conceive it requisite to observe,
 “ 1. The Strength and Quarter of the Winds, and
 “ to register the Changes as often as they happen;
 “ both which may be very conveniently shewn, by
 “ a small Addition to an ordinary Weather-cock.
 “ 2. The Degrees of Heat and Cold in the Air;
 “ which will be best observed by a sealed *Thermo-*
 “ *meter*, graduated according to the Degrees of *Ex-*
 “ *pansion*, which bear a known Proportion to the
 “ whole Bulk of Liquor, the beginning of which
 “ Gradation, should be that Dimension which the Li-
 “ quor hath, when encompassed with Water, just be-
 “ ginning to freeze, and the Degrees of *Expansion*,
 “ either greater or less, should be set or marked a-
 “ bove it, or below it.
 “ 3. The Degrees of Dryness and Moisture in the
 “ Air; which may be most conveniently observed by
 “ a *Hygroscope*, made with the single Beard of a wild
 “ Oat perfectly ripe, set upright and headed with an
 “ *Index*, after the Way described by *Emanuel Mag-*
 “ *nan*; the Conversions and Degrees of which may be
 “ measured by Divisions made on the rim of a Circle, in
 “ the

“ the *Center* of which, the *Index* is turned round :
 “ The Beginning or Standard of which Degree of
 “ *Rotation*, should be that, to which the *Index* points,
 “ when the Beard, being thoroughly wet, or covered
 “ with Water, is quite unwreathed, and becomes
 “ strait. But because of the Smalness of this Part
 “ of the Oat, the Cod of a wild *Vetch* may be used
 “ instead of it, which will be a much larger *Index*,
 “ and will be altogether as sensible of the Changes
 “ of the Air.

“ 4. The Degrees of Pressure in the Air ; which
 “ may be several Ways observed, but best of all with
 “ an Instrument with Quick-silver, contrived so, as
 “ either by means of Water, or an *Index*, it may sen-
 “ sibly exhibit the minute Variations of that Action :

“ 5. The Constitution and Face of the Sky or Hea-
 “ vens ; and this is best done by the Eye ; here should
 “ be observed, whether the Sky be clear or clouded ;
 “ and if clouded, after what Manner ; whether with
 “ high Exhalations or great white Clouds, or dark
 “ thick ones. Whether those Clouds afford Fogs or
 “ Mists, or Sleet, or Rain, or Snow, &c. Whether
 “ the under side of those Clouds be flat or waved and
 “ irregular, as I have often seen before Thunder.
 “ Which way they drive, whether all one Way, or
 “ some one way, some another, and whether any of
 “ these be the same with the Wind that Blows be-
 “ low ; the Colour and Face of the Sky at the rising
 “ and setting of the Sun and Moon ; what Haloes or
 “ Rings may happen to encompass those Luminaries,
 “ their Bigness, Form and Number.

“ 6. What Effects are produc'd upon other Bo-
 “ dies : As what Aches and Distempers in the Bodies
 “ of Men ; what Diseases are most rife, as Colds, Fe-

“ vers,

“ vers, Agues, &c. What Putrefactions or other
 “ Changes are produc’d in other Bodies ; as the swea-
 “ ting of Marble, the burning blue of a Candle, the
 “ blasting of Trees and Corn ; the unusual Sprouting,
 “ Growth, or Decay of any Plants or Vegetables ; the
 “ Putrefaction of Bodies not usual ; the Plenty or
 “ Scarcity of Insects ; of several Fruits, Grains, Flow-
 “ ers, Roots, Cattel, Fishes, Birds, any thing notable of
 “ that Kind. What Conveniences or Inconveniences
 “ may happen in the Year, in any kind, as by Floods,
 “ Droughts, violent Showers, &c. What Nights pro-
 “ duce Dews and Hoar-Frosts, and what not ?

“ 7. What Thunders and Lightnings happen, and
 “ what Effects they produce ; as souring Beer or Ale,
 “ turning Milk, killing Silkworms, &c. ?

“ Any thing extraordinary in the Tides ; as double
 “ Tides, later or earlier, greater or less Tides than
 “ ordinary, rising or drying of Springs ; Comets or
 “ unusual Apparitions, new Stars, *Ignes fatui* or
 “ shining Exhalations, or the like.

“ These should all or most of them be diligently
 “ observed and registred by some one, that is always
 “ conversant in or near the same Place.

“ Now that these, and some others, hereafter to be
 “ mentioned, may be registred so as to be most con-
 “ venient for the making of Comparisons, requisite
 “ for the raising *Axioms*, whereby the Cause or Laws
 “ of Weather may be found out ; it will be desire-
 “ able to order them so, that the Scheme of a whole
 “ Month may at one View be presented to the Eye:
 “ And this may conveniently be done on the Pages of
 “ a Book in *Folio*, allowing fifteen Days for one side,
 “ and fifteen for the other. Let each of those Pages
 “ be divided into nine Columns, and distinguished by

“ perpendicular Lines ; let each of the first six Columns be half an Inch wide, and the three last equally share the remaining of the Side.

“ Let each Column have the Title of what it is to contain, in the first at least, written at the Top of it : As, let the first Column towards the left hand, contain the Days of the Month, or Place of the Sun, and the remarkable Hours of each Day. The second, the Place, Latitude, Distance, Ages and Faces of the Moon. The third, the Quarters and Strength of Winds. The fourth, the Heat and Cold of the Season. The fifth, the Dryness and Moisture of it. The sixth, the Degrees of Pressure. The seventh, the Faces and Appearances of the Sky. The eighth, the Effects of the Weather upon other Bodies, Thunders, Lightnings, or any thing extraordinary. The ninth, general Deductions, Corollaries or Syllogisms, arising from the comparing the several *Phænomena* together.

“ That the Columns may be large enough to contain what they are designed for, it will be necessary, that the Particulars be expressed with some Characters, as brief and compendious as is possible. The two first by the Figures and Characters of the Signs commonly used in Almanacks. The Winds may be expressed by the Letters, by which they are expressed in small Sea-Cards ; and the Degrees of Strength, by 1, 2, 3, 4, &c. according as they are marked in the Contrivance in the Weather-cock. The Degrees of Heat and Cold may be expressed by the Numbers appropriate to the Divisions of the *Thermometer*. The Dryness and Moisture, by the Divisions in the Rim of the *Hydroscope*. The Pressure by Figures, denoting the Height of the *Mercurial*

“ *rial Cylinder*. But for the Faces of the Sky, they
 “ are so many, that many of them want proper Names;
 “ and therefore it will be convenient to agree upon
 “ some determinate ones, by which the most usual
 “ may be in brief exprest. As let *Clear* signify a very
 “ clear Sky without any Clouds or Exhalations:
 “ *Checquer’d* a clear Sky, with many great white round
 “ Clouds, such as are very usual in Summer. *Hazy*,
 “ a Sky that looks whitish, by Reason of the Thick-
 “ ness of the higher Parts of the Air, by some Exhala-
 “ tions not formed into Clouds. *Thick*, a Sky more
 “ whiten’d by a greater Company of Vapours: these do
 “ usually make the *Luminaries* look bearded or hairy,
 “ and are oftentimes the Cause of the Appearance of
 “ Rings and Haloes about the *Sun* as well as the *Moon*.
 “ *Overcast*, when the Vapours so whiten and thicken
 “ the Air, that the *Sun* cannot break through; and of
 “ this there are very many Degrees, which may be ex-
 “ prest by a *little, much, more, very much overcast*, &c.
 “ Let *Hairy* signify a Sky that hath many small, thin,
 “ and high Exhalations, which resemble Locks of Hair,
 “ or Flakes of Hemp or Flax; whose Varieties may
 “ be exprest by *strait* or *curv’d*, &c. according to the
 “ Resemblance they bear. Let *Water’d* signify a Sky
 “ that has many high thin and small Clouds, looking
 “ almost like water’d Tabby, call’d in some Places a
 “ Mackrel Sky. Let a Sky be call’d *Wav’d*, when
 “ those Clouds appear much bigger and lower, but
 “ much after the same manner. *Cloudy*, when the Sky
 “ has many thick dark Clouds. *Lowring*, when the
 “ Sky is not very much overcast, but hath also under-
 “ neath many thick dark Clouds which threaten
 “ Rain. The Signification of *gloomy, foggy, misty, fleet-*
 “ *ing, driving, rainy, snowy*, Reaches or Racks *va-*
 “ *riable*,

“ *riable, &c.* are well known, they being very com-
“ monly used. There may be also several Faces of
“ the Sky compounded of two or more of these,
“ which may be intelligibly enough exprest by two
“ or more of these Names. It is likewise desirable,
“ that the Particulars of the eighth and ninth Co-
“ lumns may be entred in as little Room and as few
“ Words as are sufficient to signify them intelligibly
“ and plainly.

“ It were to be wisht that there were diverse in
“ several Parts of the World, but especially in distant
“ Parts of this Kingdom, that would undertake this
“ Work, and that such would agree upon a common
“ Way somewhat after this Manner, that as near as
“ could be, the same Method and Words might be
“ made Use of. The Benefit of which Way is ea-
“ sily enough conceivable.

“ As for the Method of using and digesting those
“ so collected Observations; that will be more ad-
“ vantageously considered when the *Supellex* is pro-
“ vided; a Workman being then best able to fit
“ and prepare his Tools for his Work, when he sees
“ what Materials he has to work upon.

A S C H E M E,

AT ONE

View representing to the Eye the Observations of the
WEATHER for a Month.

Days of the Month and Place of the Sun.	Remarkable Houfes.	Age and Sign of the Moon at Noon.	The Quarters of the Wind and its Strength.	The Degrees of Heat and Cold.	The Degrees of Drynefs and Moisture.	The Degrees of Pref- ure.	The Faces or vifible Ap- pearances of the Sky.	The notableft Effects.	General De- ductions to be made after the Side is fitted with Obser- vations: As,
14 II	4 12	27 8 9.46	W.	29 3 12 1/2 3 1/2 16	2 5 2 8	29 1/10 29 1/8	Clear Blue, but Yellowifh in the N. E clouded to- ward the S. checker'd Blue.	A great Dew Thunder, far to the South. A very great Tide.	From the laft Q. of the Moon to the Change he Wea- ther was very temperate, but cold for the Season; the Wind pretty constant be- tween N. & W. A little before the laft great Wind, and till the Wind rofe at its height, the Quick-fil- ver continued defcending till it came very low; after which it be- gan to reaf- cend, &c.
12.46 II	4 12	Perigee.	W. SW.	10 1/2 7 1/2 1/2	2 9 2 2 1/2	29 1/10 22 1/2	A clear Sky all Day, but a little check- er'd at 4. P.M. at Sun-fet red and hazy.	Not by much fo big a Tide as Yesterday. Thunder in the North.	
15 II	8 4	28	N. W.	3 9 4	28 1/1 2 9	29 1/10 29 1/8	A clear Sky all Day, but a little check- er'd at 4. P.M. at Sun-fet red and hazy.	Not by much fo big a Tide as Yesterday. Thunder in the North.	
13.40 II	5 10	8 24.51	N.	2 8 1	2 9 2 10	29 1/8 29	at Sun-fet red and hazy.		
16 II	10 14.37	N Moon at 7. 25. A. M. II 10.8	S.	1 10 10	10 28 1/2	28 1/2 28 1/2	Overcaft and very lower- ing.	No Dew upon the Ground, but very much upon Marble-ftones &c.	
		&c.	&c.	&c.	&c.	&c.	&c.		

DIRECTIONS

FOR THE

Observations of the Eclipses of the Moon.

By Mr. ROOKE.

“ E Clipses of the Moon are observ’d for two principal Ends; one *Astronomical*, that by comparing Observations with Calculations, the *Theory* of the *Moon’s* Motion may be perfected, and the Tables thereof reform’d: The other *Geographical*, that by comparing among themselves Observations of the same *Ecliptical Phases*, made in diverse Places, the Difference of *Meridians*, or *Longitudes* of those Places, may be discover’d.

“ The Knowledge of the *Eclipse’s* Quantity and Duration, the Shadows, Curvity and Inclination, &c. conduce only to the former of these Ends: The exact Time of the Beginning, Middle, and End of the *Eclipses*, as also in total ones, the Beginning and End of total Darkness, is useful for both of them.

“ But because these Times considerably differ in Observations made by the bare Eye, from those with a *Telescope*, and because the Beginning of *Eclipses* and the End of total Darkness are scarce to be observ’d exactly, even with Glasses; one not being able clearly to distinguish between the true Shadow and *Penumbra*, unless one have seen, for some time before, the Line, separating them, pass along upon
“ the

“ Let there be of the eminentest Spots, dispersed
“ over all Quarters of the *Moon's* Surface, a select
“ Number generally agreed on, to be constantly made
“ use of to this Purpose, in all Parts of the World :
“ As for Example, those which *Hevelius* calleth

“ Mons { Sinai
 { Etna
 { Porphyrites Insula
 { Serrorum { Besbicus
 { Creta Palus { Mæotis
 { Maræotis.

Lacus Niger Major.

The HISTORY of

" Let in each *Eclipse* (not all, but for instance)
 " three of these Spots, which then lye nearest to the
 " *Ecliptic*, be exactly observ'd, when they are first
 " touched by the true Shadow, and again when they
 " are just completely entred into it; and (if you
 " please) also in the Decrease of the *Eclipse*, when
 " they are first fully clear from the true Shadow:
 " For the accurate Determination of which Mo-
 " ments of Time (that being in this Business of main
 " Importance) let there be taken *Altitudes* of re-
 " markable fixed Stars, on this side the Line, of
 " such as lye between the *Equator* and *Tropic* of
 " *Cancer*; but beyond the Line, of such as are si-
 " tuated towards the other *Tropic*; and in all Pla-
 " ces, of such, as at the time of Observation, are
 " about four Hours distant from the *Meridian*.

Mr. ROOKE'S DISCOURSE

Concerning the Observations of the Eclipses
of the *Satellites of Jupiter.*

*L*ongitudinis sive Differentiæ Meridianorum scientia
est vel *Nautica*; vel *Geographica*.

Illa Navis aquæ innatantis; Hæc Urbium, Insularum, Promontiorum, &c. Globo terrestri adhærentium situm investigat.

In Navi, motu vario subinde translata, Observatio identidem est repetenda; at loci terreni, fixam perpetuam sedem obtinentis, positionem semel determinasse sufficit.

Maria, fluctibus ut plurimum agitata, subtile Instrumentorum, præsertim Telescopii longioris tractationem minime permittunt.

Longitudinis scientia Nautica vix unquam de Cælo expectanda; Geographica vero ab Eclipsibus Corporum cælestium præcipue petenda.

Eclipses sunt vel { *Veteribus notæ, scil. Solis & Lunæ,*
Satellitum Jovis, ante Tubi Optici
usum incognitæ.

(Missam fecimus Cl. Hugonii Lunulam Saturniam Observatu difficiliorem.)

Illarum per multa retro sæcula Observationes; ne duo quidem loca quantum Meridianorum intercapidinem habeant, satis certò definitum esse experimur; harum verò per pauculos annos adhibendâ diligenti animad-

versione; præcipuæ totius terrarum Orbis partes, quomodo ad se invicem sitæ sint, accuratius determinatum iri non desperamus.

Causæ, ob quas minùs in hoc negotio præstitere Eclipses Luminarium.

Sunt { 1. Communis utrisque, ipsarum Raritas
 Propria { 2. Solari, Parallaxis Lunæ.
 3. Lunari, Penumbra Terræ.

His ergo præferimus Satellitum Jovialium Defectus frequentissimos, sine ulla Parallaxi, in quibus etiam Penumbra Jovis prodesse magis, quam officere videtur.

Methodus Longitudinis, ex Eclipsibus vel aliis Phænomenis cælestibus, indagandæ duplex est: Una, cum Tempore ad Meridianum Tabularum proprium supputato, Tempus alibi observatum; Altera, Tempora variis in locis observata, inter se comparat.

Cum Arti nauticæ prior illa unice interserviat, quæ Motus cælestes accuratius multò, quam nobis sperandum videtur, cognitos supponit; ob Astronomicæ Imperfectionem, & Observationum marinarum Hallucinationem perpetuo ferè necessariam: supra pronuntiavimus Longitudinis Scientiam nauticam vix unquam de Cælo expectandam.

Methodus altera, Geographiæ perficiendæ idonea, cum non aliam ob causam prævium Calculum adhibeat, nisi ut eo moniti plures, eidem Phænomeno, in dissitis locis, observando simul invigilent; Periodorum atque Epocharum ἀκριβειαν minime desiderat.

Satellites Jovis numero sunt quatuor, varia apud Autores Nomina sortiti; nos ex diversis, quæ a Jove obtinent Intervallis, 1. Intimum, 2. Penintimum, 3. Penextimum, 4. Extimum appellabimus.

Horum

Horum non nisi uniusmodi φαινόμενον observandum proponimus; Imersionem nempe in Umbram Jovis sive ipsum Eclipsæw initium.

Solam hanc φάσιν seligimus, utpote in indivisibili fere constitutam: Licet enim Luminis Languor atque Diminutio Moram aliquantulam trabere possit, omnimoda tamen Extinctio & Evanescentia (de qua unice solliciti sumus) Momento quasi contingere deprehendetur.

Ante 8 ☉ 4 Satellites ad Occidentem, Disci Jovialis Respectu, in Deliquia incidunt; post Acronychia, ad Orientem.

Intimi & (nisi fortè rarissimè) penintimi Eclipsæw tantum Occidentalium Initia nobis apparere possunt: duorum autem remotiorum multa etiam Orientalium Exordia conspiciere licet.

Defectus Medicæorum observatu faciliores reddant.

1. Major Planetarum Claritas. 2. Motus ipsorum tardior. 3. Penumbra Jovis crassior. 4. Longius à Joviali Disco intervallum: ad Observationum ἀκριβείαν conducit. 1. Motus Satellitum velocior. 2. Penumbra Jovis angustior.

Hæc omnia nobiscum meditati, subductâ benè singulorum Ratione, Satellitum intimum & penextimum ad Rem nostram præ cæteris accommodatos; atque adeo, cum satis frequentes sint ipsorum Eclipses, solos adhibendos esse judicamus.

Extimum omninò negligimus, utpotè minimum omnium & obscurissimum; præsertim verò quod tantâ nonnunquam sit Latitudine præditus, ut Umbra Jovis ipsum Aphelium neutiquam attingat.

Penintimus autem nullâ gaudet ex suprâ recensitis Prærogativâ, quæ alterutri saltem eorum, quos jam prætulimus, potiori Jure non debeat.

Maxima Satellitum in Umbra incidentium à Limbo
A a Disci

Disci Jovialis Distantia, unâ aut alterâ, post priorem Solis & Jovis Quadraturam, Hebdomadâ contingit.

Estque ea penextimi Sesquidiametro Jovis ferè æqualis: Intimi verò Semidiametro ejusdem non multo major, sextâ ante memoratam Quadraturam Hebdomadâ. Penextimus Umbra ingrediens Diametro Jovis à Disco abest: Augendâ indè usque ad maximam Distantiâ, Incremento non uniformi, sed continuè decrescente.

Hinc iisdem reciproce passibus (Decremento sc. sensim increscente) diminuitur istiusmodi Intervallum, ad bimestre usque Tempus à dictâ Quadraturâ elapsam, quando iterum Diametro Joviali æquatur.

Posteâ autem usque ad ipsa Acronychia, penextimus Umbra subiturus, æquabili ferè Gradu (singulis nempe Hebdomadis Quadrante Diametri) promotus, ad Limbum Jovis accedit. Intimi, pro diverso Jovis ad Solem Situ, Distantia eâdem planè ratione variatur: ejus enim, quam ubique obtinet, penextimus, Trienti fere perpetuo est æqualis.

Mense circiter post Jovem Soli oppositum, penextimus (Intimi post 8 ☉ ♃, Immersiones observari non posse supra innuimus) simulac Corporis Jovialis Limbum orientalem transferit, occidentalem Umbra continuo intrabit.

Inde augetur paulatim penextimi evanescentis Distantia, donec unâ aut alterâ ante posteriorem Quadraturam Hebdomadâ, maxima evadat; quando à Disci Jovialis Margine Semidiametro ejusdem removetur.

Postquam autem hucusque diminutâ sensim Velocitate, Umbra Jovis ab iphus Disco recessit: hinc, Motu continuè accelerato, ad eundem redit.

Per bimestre ante & post Jovis cum Sole Conjunctiōnem Spatium, in Locis Longitudine multum differentibus, eadem Eclipsis apparere nequit: adeoque tunc
Temporis

Temporis Observationes instituere non est Operæ Pretium.

Quæ cum ita sint, Tempus quadrimestre, à Sextili priori usque ad ipsa ferè Acronychia numerandum, utriusque Satelliti observando erit unice opportunum: Penextimi autem soli, insuper trimestre, ab altero post Oppositionem mense ad Sextilem posteriorem.

Intra tempora jam definita, octoginta circiter utriusque simul Satellitis fient Eclipses; penextimi sc. fere triginta, intimi autem quinquaginta.

Has cum non ubiuis terrarum, sed aliæ aliis in locis sint conspiciendæ, in sex Classes digeremus.

- | | |
|--|---|
| 1. In Europâ & Africâ. | } Eclipses
servandas
compre-
hendet. |
| 2. In Asiâ. | |
| 3. In Americâ. | |
| 4. In Europa Africa & Asia. | |
| 5. In Europa Africa & America. | |
| 6. In Asia Orient. & America Occident. | |

Non opus est fortè ut moneamus in Insulis

*Oceani { Æthiopici } observandam esse classẽ { 4^{am}.
Atlantici } 5^{am}.
Pacifici } 6^{am}.*

Calculus Eclipsium à nobis exhibendus, in ipso fortasse Loco ad quem instituitur, plus Horâ integrâ nonnunquam à vero observabit, ob variam sc. in Satellitum motu ἀνομαλίαν, ab Excentricitate (ut verisimile est) & propriarum ipsis Orbitalium ad Jovis Orbitam Inclinatione oriundam.

Alibi autem terrarum multo minus Calculo fidendum, propter incertam insuper in plerisque Locis Meridiano-

rum Differentiam; quæ tamen ut fiat, Reductio Temporis aliqua utcumque adhibenda est.

Longam itaque futuram sæpiuscule Eclipsium harum Expectationem præmonemus, assiduamque interim Attentionem, nec (ob καίρῳ admodum ὄζῳ) unquam fere interruptam, esse continuandam: primum enim, quum Visu assequi possumus Luminis Diminutionem, brevissimâ (præsertim in intimo) interpositâ Morulâ mox insequitur perfecta ejus Extinctio.

Molestum autem in observando Tædium, summa Τηγήσεων ἀκριβεία abunde compensabit, idemque plurimum minuit, Sociorum mutuas operas tradentium, ubi suppetit Præsentia.

Ad momenta temporis accuratissime notanda (quod in hujusmodi Observationibus est Palmarium) perutile erit Horologium Oscillatorium, ab ingeniosissimo & candidissimo Hugenio feliciter excogitatum.

A P P E N D I X.

Longitudinis scientiam Nauticam vix unquam de Cælo expectandam, suprâ asseruimus; siqua tamen ejusmodi aliquando futura est, non aliud Fundamentum, quam Lunarium Motuum præcisam Cognitionem, habitura videtur. Horum autem Restitutionem à Parallaxi inchoandam, solertissime monuit Keplerus. Parallaxeos verò indagandæ, & à Lunæ latitudine (cui semper ferè complicatur) distinguendæ, optima (si non sola) Methodus est, quæ, in Regionibus longe diffitis & sub eodem Meridiano positis, Altitudinum Lunæ meridianarum, per singulas Orbitæ Partes simul observatarum serie innititur: inde enim, Polorum Elevatione solum præcognita, certissima innotescit Globi Lunarisi à Terrestri Distantia.

Proponimus itaque nos Africae Promontorium Cap. Bonae Spei, vel in Oceano Atlantico Sanctae Helenae Insulam, cum locis in Europa iis respondentibus, Satellitum Ope, ut docuimus, determinandis, in quibus istiusmodi Observationes commodissime instituantur.

Upon the reading of these last *Directions*, Mr. *Rook* the Author of them being dead, I cannot forbear saying something of that excellent Man, which his incomparable *Modesty* would not have permitted me to write, if he had been living. He was indeed a Man of a profound *Judgment*, a vast *Comprehension*, prodigious *Memory*, solid *Experience*. His *Skill* in the *Mathematicks* was reverenc'd, by all the Lovers of those Studies; and his *Perfection* in many other Sorts of Learning deserves no less Admiration. But above all, his *Knowledge* had a right Influence on the Temper of his Mind, which had all the Humility, Goodness, Calmness, Strength, and Sincerity of a sound and unaffected *Philosopher*. This is spoken, not of one who liv'd long ago, in praising of whom it were easie to *feign* and to exceed the *Truth*, where no Man's Memory could confute me: but of one who is lately dead, who has many of his Acquaintance still living, that are able to confirm this *Testimony*, and to join with me, in delivering down his Name to Posterity, with this just Character of his *Virtues*. He died in the year sixty two, shortly after the Establishment of the *Royal Society*, whose *Institution* he had zealously promoted. And it was a deplorable Accident in his Death; that he deceas'd the *very night* which he had for some years expected, wherein to finish his accurate Observations on the *Satellites* of *Jupiter*: however this *Treasure* will not be lost, for the *Society* has

refer'd

refer'd it to some of the best *Astronomers* of *Europe*, to bring his *Beginnings* to *Conclusion*.

Sect. XXXI.
Their Pro-
posals and
Recommen-
dations.

To many of these *Queries* they have already receiv'd good *Returns*, and *Satisfaction*; and more such *Accounts* are daily expected from all *Coasts*. Besides these, there have been several great and profitable *Attempts*, relating to the Good of Mankind, or the *English Nation*, propounded to them by many publick Bodies, and private Persons; which they have again recommended, to be examin'd apart by diverse of their own *Number*, and by other Men of *Ability* and *Integrity*, who have accepted of their *Recommendations* of this Kind: The principal that I find recorded in their *Registers*, are these.

They have propounded the composing a *Catalogue* of all *Trades*, *Works*, and *Manufactures*, wherein Men are employ'd; in order to the collecting each of their *Histories*, by taking notice of all the physical *Receipts* or *Secrets*, the *Instruments*, *Tools*, and *Engines*, the manual *Operations* or *Slights*, the *Cheats* and ill *Practices*, the *Goodness*, *Baseness*, and different *Value* of *Materials*, and whatever else belongs to the *Operations* of all *Trades*.

They have recommended the making a *Catalogue* of all the Kinds of *natural Things* to be found in *England*. This is already in a very good *Forwardness*: And for its better completing, many *Expedients* for the preserving, drying and embalming of all living *Creatures* have been prosecuted.

They have suggested the making a perfect *Survey*, *Map*, and *Tables*, of all the fix'd Stars within the *Zodiac*, both visible to the naked Eye, and discoverable by a six-foot *Telescope*, with a large *Aperture*; towards

the observing the apparent Places of the Planets, with a *Telescope*, both by Sea and Land. This has been approv'd, and begun, several of the *Fellows* having their Portions of the Heavens allotted to them.

They have recommended the advancing of the *Manufacture of Tapestry*: the improving of *Silk-making*: the propagating of *Saffron*: the melting of *Lead-Oar* with Pit-coal: the making Iron with Sea-coal: the using of the Dust of black Lead instead of Oil in Clocks: the making *Trials* on *English* Earths, to see if they will not yield so fine a Substance as *China*, for the perfecting of the Potter's Art.

They have *propounded* and *undertaken* the comparing of several *Soils* and *Clays*, for the better making of *Bricks* and *Tiles*: the Way of turning *Water* into *Earth*; the observing of the Growth of Pebbles in Waters: the making exact *Experiments* in the large *Florentine* Loadstone: the Consideration of the *Bononian* Stone: the examining of the Nature of *petrifying Springs*: the using an *Umbrella Anchor*, to stay a Ship in a Storm: the Way of finding the *Longitude* of Places by the *Moon*: the Observation of the Tides about *Lundy*, the Southwest of *Ireland*, the *Bermudas*, and diverse parts of *Scotland*: and in other Seas and Rivers, where the ebbing and flowing is found to be irregular.

They have started, and begun to practise, the Propagation of *Potatoes*; the planting of *Verjuice Grapes* in *England*; the chymical Examination of *French* and *English* Wines; the gradual Observation of the Growth of *Plants*, from the first Spot of Life; the increasing of *Timber*, and the planting of Fruit-Trees, which they have done by spreading the Plants into many Parts of the Nation, and by publishing a
large

The HISTORY of

large *Account* of the best Ways of their Cultivation.

They have propounded and attempted with great Effect, the making *Experiments* with *Tobacco Oil*; the anatomising of all amphibious Creatures, and examining their Lungs; the observing the Manner of the *Circulation* of the Blood in Fishes; the Ways of transporting Fish from one Place to another for Breed; the *collecting Observations* on the *Plague*; the examining of all the several Ways to breed *Bees*; the altering the Taste of the Flesh of *Animals*, by altering their Food; the Probability of making *Wine* out of *Sugar-Canes*: Which last I will set down as one Example.

P R O P O S A L

For making WINE.

By Dr. GODDARD.

IT is recommended to the Care of some skilful Planters in Barbadoes, to try whether good Wine may not be made out of the Juice of Sugar-canes. That which may induce them to believe this Work to be possible, is this Observation, that the Juice of Wine, when it is dried, does always granulate into Sugar, as appears in Raisins, or dried Grapes: and also that in those Vessels wherein acute, or unfermented Wine is put, the Sides are wont to be cover'd over with a Crust of Sugar. Hence it may be gather'd, that there is so great a Likeness of the Liquor of the Cane, to that of the Vine, that it may probably be brought to serve for the same Uses. If this Attempt shall succeed, the Advantages of it will be very considerable. For the English being the chief Masters of the Sugar Trade, and that falling very much in its Price of late Years, while all other outlandish Productions are risen in their Value; it would be a great Benefit to this Kingdom, as well as to our Western Plantations, if part of our Sugar, which is now in a manner a meer Drug, might be turned into Wine, which is a foreign Commodity, and grows every Day dearer; especially seeing this might be done, by only bruising and pressing the Canes, which would be a far less Labour and Charge, than the Way by which Sugar is now made.

The HISTORY of

These are some of the most advantageous *Proposals* they have scattered and encouraged in all Places, where their Interest prevails. In these they have recommended to many distinct and separate *Trials*; those Designs, which some private Men had begun, but could not accomplish, by reason of their *Charge*; or those which they themselves have devis'd, and conceived capable of Success; or even those of which Men have hitherto seem'd to despair. Of these, some are already brought to a hopeful Issue; some are put in Use, and thrive by the Practice of the Publick; and some are discover'd to be feasible, which were only before thought imaginary, and fantastical. This is one of the greatest *Powers* of the true and unwearied *Experimenter*, that he often rescues Things from the Jaws of those dreadful Monsters, *Improbability*, and *Impossibility*. These indeed are two frightful Words to weaker Minds, but by diligent and wise Men, they are generally found to be only the Excuses of *Idleness* and *Ignorance*. For the most part, they lie not in the Things themselves, but in Men's false *Opinions* concerning them; they are rais'd by *Opinions*, but are soon abolish'd by *Works*. Many *Things*, that were at first improbable to the Minds of Men, are not so to their Eyes; many that seem'd impracticable to their *Thoughts*, are quite otherwise to their *Hands*: many that are too difficult for their naked Hands, may be soon performed by the same Hands, if they are strengthen'd by *Instruments*, and guided by *Method*: many that are unmanageable by a few Hands, and a few Instruments, are easy to the joint Force of a Multitude: many that fail in one *Age*, may succeed by the renew'd Endeavours of *another*. It is not therefore the Conceit or Fancy of Men alone, that is of suffi-

cient Authority to condemn the most unlikely Things for *impossible*; unless they have been often attempted in vain; by many *Eyes*, many *Hands*, many *Instruments*, and many *Ages*.

This is the *Assistance* and *Information* they have SECT. XXXII. given to others to provoke them to enquire, and to The Relations of Things of Nature and Art, they have receiv'd. order and regulate their *Inquisitions*. To these I will add the *Relations* of the Effects of *Nature* and *Art*, which have been communicated to them. These are infinite in Number: And though many of them have not a sufficient Confirmation to raise *Theories*, or *Histories* on their *Infallibility*; yet they bring with them a good Assurance of Likelihood, by the Integrity of the *Relators*; and withal they furnish a judicious *Reader* with admirable Hints to direct his Observations. For I will once more affirm, that as the Minds of Men do often mistake *Falshoods* for *Truths*, though they are ever so circumspect; so they are often drawn by uncertain, and sometimes erroneous *Reports*, to stumble on *Truths* and *Realities*. Of this vast Heap of *Relations*, which is every where scattered in their *Entry Books*, I will only take notice of these occasional *Accounts*.

Relations of two new Kinds of *Stars*, observed in the Year sixty-six, the one in *Andromeda*, the other in *Cygnus*, in the same Place where they appeared sixty Years since, and have ever since disappear'd; of several Observations of *Cælestial Bodies* made in *Spain*; of Observations of several of the *Planets* made at *Rome*, and in other Parts, by extraordinary *Glasses*; of the comparative Goodness of *Glasses* us'd in other Countries; of several *Eclipses* observ'd in diverse Parts of the World.

Relations of *Parhelii*, and other such Appearances

seen in *France* ; of the Effects of *Thunder* and *Lightning* ; of *Hurricanes*, and *Spouts* ; of the Bigness, Figure, and Effects of *Hailstones* ; of *Fish*, and *Frogs* said to be rain'd ; of the raining of Dust out of the *Air*, and of the Distance it has been carried by great *Fires* and *Earthquakes* ; of Changes of Weather, and a Way of predicting them ; of the Vermination of the *Air* ; of the suppos'd raining of *Wheat* in *Glocestershire*, which being sown was found to be nothing but *Ivy Berries*.

Relations of a *Spring* in *Lancashire*, that will presently catch Fire on the Approach of a Flame ; of *Burning-glasses* performing extraordinary Effects ; of *Burning-glasses* made with Ice ; of *Fire balls* for Fuel ; of a more convenient Way of using *Wax-Candles* ; of the kindling of certain Stones, by their being moistened with Water ; of using ordinary Fuel to the best Advantage.

Relations of the Times of the rising and disappearing of *Springs* ; of artificial *Springs* ; of the Natures of several of our *English Springs*, and of other *oleaginous* and *bituminous Springs* : of the Fitness and Unfitness of some Waters for the making of *Beer* or *Ale* ; of brewing *Beer* with *Ginger* instead of *Hops* ; of *Tides* and *Currents* ; of *petrifying Springs* ; of the Water-blasts of *Tivoly* ; of *floating Islands* of *Ice* ; of the shining of *Dew* in a Common of *Lancashire*, and elsewhere ; of *Divers*, and *Diving*, their Habit, their long holding their Breath, and of other notable *Things* observ'd by them.

Relations of the Effects of *Earthquakes*, and the moving and sinking of Earths ; of deep *Mines*, and deep *Wells* ; of the several Layers of Earth in a Well at *Amsterdam* ; of the shining Cliffs in *Scotland* ; of the Layers of Earth observ'd in diverse Cliffs ; of *Screw-Stones*,

Stones, Lignum Fossile, Blocks buried in *Exeter River*, Trees found under Ground in *Cheshire, Lincolnshire*, and elsewhere; of a Coal-Mine wrought half a Mile from the Shoar, under the Sea; of the fatal Effects of *Damps* on *Miners*, and the Ways of recovering them.

Relations of the extraordinary Strength of some small *Loadstones*, taking up above 150 Times their own Weight; of several *English Loadstones*; of the Variation of the *Loadstone* observ'd in two *East-India* Voyages, and other Places; of the growing of *Pebbles* inclos'd in a Glas of Water; of several excellent *English Clays*; of Gold found in little Lumps in a Mine in *England*; of the moving Sands in *Norfolk*.

Relations about refining *Lead*, and *Tin-Oar*; of hardning *Steel* so as to cut *Porphyry* with it, and softning it so much, as to make it easy to be wrought on; of impregnating *Lead Oar* with *Metal*, after it has been once freed; of *petrify'd Teeth*, and a petrify'd human *Fætus*; of several Ways of splitting Rocks; of living Muscles found in the midst of Rocks at *Leghorn*; of the Way of making *Quicksilver*; of Things observable at the Bottom of the Sea; of a soft Metal, which hardens after it has taken off the Impression, and the Way of reducing such Impressions into as small a Proportion as is desired.

Relations about *Agriculture*; of ordering of *Vines*; of the setting and planting of Trees several Ways; of *Elms* growing from Chips, of new Trees sprung from rotten Roots; of several Kinds of Trees, growing one out of another, and in the Place of others; of the best Ways of Pruning; of making a Kind of Silk with *Virginia* Grass; of a Kind of Grass making stronger Ropes than the common Hemp; of a new Way of ordering

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dering *Mulberry* Trees in *Virginia*; of a *Locust-Tree* *Bow* standing bent six Months without losing its *Spring*; of a way of improving the planting of *Tobacco*.

Relations of the Usefulness of changing Seed yearly; of the steeping, liming, sowing it several Ways; of freeing it from Worms; preserving it long (as *eighty Years*) of freeing it from *Smut*; of the Causes and first Signs of *Smut*; of the *Instrument* and Way of chopping Straw, for the feeding of Horses; of Plants growing in *meer Water*; of others growing in *meer Air*; of several *Indian Woods*; of the growing of the divided Parts of *Beans*, of the growing of chop'd Stalks of *Potatoes*; of ordering *Melons*; of keeping their Seed, and producing extraordinary good ones without *Transplanting*.

Relations of the Growth, Breeding, Feeding, and Ordering of *Oysters*; of a *Sturgeon* kept alive in *St. James's-Park*; of the moveable Teeth of *Pikes*; of young *Eels* cut alive out of the old one's Belly; of the transporting Fish Spawn, and *Carps* alive from one Place to another; of the strange Increase of *Carps* so transported; of *Snake-Stones* and other *Antidotes*; of *Frogs*, *Frog-spawn*, *Toads*, *Newts*, *Vipers*, *Snakes*, *Rattle-Snakes*.

Relations of several Kinds of *Poisons*, as that of *Maccassar*, and *Florence*; of *Craw-fishes*; of the Generation, Growth, Life, and Transformation of *Ants*; of *Cheese Worms* leaping like *Fleas*, of living Worms found in the Entrails of *Fishes*; of *Insects* found in the sheathing of Ships; of the Generation of *Insects* out of dead *Cantharides*; of *Insects* bred in Men's Teeth, Gums, Flesh, Skin; of great Quantities of *Flies* living in Winter, tho' frozen; of the Ways of ordering *Silk-Worms* in *France*, *Italy*, *Virginia*; and of their not being hurt in *Virginia* by Thunder.

Rela-

Relations of Swallows living after they had been frozen under Water; of *Barnacles* and *Solan Geese*, of a new Way of hatching *Pigeons*; of the Way of hatching *Chickens* in *Egypt*; of *Eggs* proving fruitful, after they had been frozen; of recovering a *tired Horse* with Sheep's Blood.

Relations of several Monsters with their Anatomies; of the Measure of a Giant-Child; of Stones found in several Parts of the Body; of an unusual Way of cutting the Stone out of the *Bladder*; of a Woman's voiding the Bones of a *Child* out of her Side, eighteen Years after her having been *with Child*; of grafting Teeth, and making the Teeth of one Man grow in the Mouth of another.

Relations of several Chirurgical Operations; of renewing the beating of the Heart, by blowing into the *Receptaculum Chyli*; of the Art of perfectly restoring Nerves transversely cut, practis'd in *France*; of a *Mummy* found in the Ruins of *St. Paul's*, after it had lain buried above 200 Years; of breaking the Nerve to the *Diaphragm*, and of its Effects; of cutting a *Steatoma* out of a Woman's Breast; of making the Blood *florid* with *Volatile*, and *coagulating* with *Acid Salts*.

Relations of sympathetick Cures and Trials; of the Effects of *Tobacco Oil* for casting into Convulsion Fits; of *Moors* killing themselves by holding their Breaths; of walking on the Water by the Help of a Girdle filled with Wind; of *Pendulum* Clocks; of several rare Guns, and Experiments with them; of new *Quadrants* and *Astronomical* Instruments; of Experiments of *Refraction* made by the *French Academy*; of a Way to make use of Eggs in Painting, instead of Oil; of the Island *Hirta* in *Scotland*; of the *whispering Place* at *Gloucester*; of the *Pike of Tene-
riffe*.

The HISTORY of
A
RELATION
OF THE
PICO TENERIFFE,
RECEIV'D FROM

Some considerable Merchants and Men
worthy of Credit, who went to the Top
of it.

“ **H**AVING furnished our selves with a Guide, Ser-
 “ vants, and Horses to carry our Wine and
 “ Provisions, we set out from *Oratava*, a Port Town
 “ in the Island of *Teneriffe*, situated on the *North* of
 “ it, two Miles distant from the main Sea. We tra-
 “ velled from twelve at Night till eight in the Morn-
 “ ing, by which Time we got to the Top of the first
 “ Mountain towards the *Pico de Terroira*; here, un-
 “ der a very great and conspicuous Pine-Tree, we
 “ brake our Fast, dined and refresh'd our selves till
 “ two in the Afternoon; then we proceeded thro'
 “ much sandy Way, over many lofty Mountains, but
 “ naked and bare, and not cover'd with any Pine-
 “ Trees, as our first Night's Passage was. This expo-
 “ sed us to excessive Heat, till we arrived at the
 “ Foot of the *Pico*; where we found many huge
 “ Stones, which seem'd to have been fallen down
 “ from some upper Part.

“ About

“ About six a Clock this Evening, we began to ascend up the *Pico*, but being now a Mile advanced, and the Way no more passable for our Horses, we quitted and left them with our Servants: In this Mile’s Ascent some of our Company grew very faint and sick, disorder’d by Fluxes, Vomiting, and aguish Distempers, our Horses Hair standing upright like Bristles; but calling for some of our Wine, which was carried in small Barrels on a Horse, we found it so wonderfully cold, that we could not drink it till we had kindled a Fire to warm it, altho’ yet the Temper of the Air was very calm and moderate. But when the Sun was set it began to blow with that Violence, and grew so cold, that taking up our Lodging under certain great Stones in the Rocks, we were constrained to keep great Fires before the Mouths of them all Night.

“ About four in the Morning we began to mount again, and being come about a Mile up, one of the Company fail’d, and was able to proceed no farther. Here began the black Rocks. The rest of us pursued our Journey till we came to the *Sugar-loaf*, where we began to travel again in a white Sand, being fore-shod with Shoes whose single Soles are made a Finger broader than the upper Leather, to encounter this difficult and unstable Passage; being ascended as far as the black Rocks, which are all flat, and lie like a Pavement, we climbed within a Mile of the Top of the *Pico*, and at last we gained the *Summit*, where we found no such Smoak as appeared a little below, but a continual breathing of a hot and sulphurous Vapour, which made our Faces extremely sore.

“ In this Passage we found no considerable Altera-

The HISTORY of

“ tion of Air, and very little Wind ; but being at the
 “ top, it was so impetuous, that we had much ado to
 “ stand against it, whilst we drank the King’s Health,
 “ and fir’d each of us a Piece. Here we also brake
 “ Fast, but found our Strong-water had quite lost its
 “ Force, and was become almost insipid, whilst our
 “ Wine was rather more spirituous and brisk than
 “ it was before.

“ The Top on which we stood, being not above a
 “ Yard broad, is the Brink of a Pit called the *Caldera*,
 “ which we judged to be about a Musket-shot over,
 “ and near fourscore Yards deep, in Shape like a *Cone*,
 “ within hollow like a Kettle or Cauldron, and all
 “ over cover’d with small loose Stones mixt with
 “ Sulphur and Sand ; from amongst which issue diverse
 “ Spiracles of Smoak and Heat, when stirred with any
 “ thing puffs and makes a noise, and so offensive, that
 “ we were almost stifled with the sudden Emanation
 “ of Vapours upon the removing of one of these
 “ Stones, which are so hot as they are not easily to
 “ be handled. We descended not above four or five
 “ Yards into the *Caldera*, in regard of its sliding from
 “ our Feet and the Difficulty. But some have ad-
 “ ventured to the Bottom. Other observable Mate-
 “ rials we discover’d none, besides a clear sort of *Sul-*
 “ *phur*, which looks like Salt upon the Stones.

“ From this famous *Pico*, we could ken the *Grand*
 “ *Canaria*, fourteen Leagues distant, *Palma* eighteen,
 “ and *Gomera* seven Leagues, which Interval of Sea
 “ seem’d to us not much larger than the River of
 “ *Thames* about *London* : We discerned also the *Her-*
 “ *ro*, being distant above twenty Leagues, and so to
 “ the utmost Limits of the Sea much farther.

“ So soon as the Sun appeared, the Shadow of the

“ *Pico*

“ *Pico* seemed to cover, not only the whole Island,
 “ and the *Grand Canaries*, but the Sea to the very
 “ *Horizon*, where the Top of the *Sudar-loaf* or *Pico*
 “ visibly appeared to turn up and cast its Shade into
 “ the Air itself, at which we were much surprized :
 “ But the Sun was not far ascended, when the Clouds
 “ began to rise so fast, as intercepted our Prospect
 “ both of the Sea, and the whole Island, excepting
 “ only the Tops of the subjacent Mountains, which
 “ seem’d to pierce them through : whether these
 “ Clouds do ever surmount the *Pico* we cannot say,
 “ but to such as are far beneath, they sometimes seem
 “ to hang above it, or rather wrap themselves about
 “ it, as constantly when the North-west Wind blows ;
 “ this they call the *Cappe*, and is a certain Progno-
 “ stick of ensuing Storms.

“ One of our Company, who made this Journey
 “ again two Years after, arriving at the Top of the
 “ *Pico* before Day, and creeping under a great Stone
 “ to shroud himself from the cold Air (after a little
 “ Space) found himself all wet, and perceived it to
 “ come from a perpetual trickling of Water from
 “ the Rocks above him. Many excellent and very
 “ exuberant Springs we found issuing from the Tops
 “ of most of the other Mountains, gushing out in
 “ great Spouts, almost as far as the huge Pine-Tree
 “ which we mention’d.

“ Having stay’d some time upon the Top, we all
 “ descended by the sandy Way till we came to the
 “ Foot of the *Sugar-loaf*, which being steep, even
 “ to almost a Perpendicular, we soon passed. And here
 “ we met a Cave of about ten Yards deep, and fifteen
 “ broad, being in Shape like an Oven or *Cupola*, having
 “ a Hole at the Top which is near eight Yards over ;

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“ by this we descended by a Rope, which our Ser-
 “ vants held at the Top, whilst the other end being
 “ fastned about our Middles, we swing ourselves,
 “ till being over a Bank of Snow, we slide down,
 “ and light upon it. We were forced to swing thus
 “ in the Descent, because in the middle of the Bot-
 “ tom of this Cave, opposite to the Overture at the
 “ Top, is a round Pit of Water, resembling a Well,
 “ the Surface whereof is about a Yard lower than
 “ the Snow, but as wide as the Mouth at Top, and
 “ is about six Fathom deep. We suppose this Water
 “ not a Spring, but dissolv’d Snow blown in, or
 “ Water trickling through the Rocks.

“ About the Sides of the Grot, for some height,
 “ there is Ice and Icicles hanging down to the Snow.
 “ But being quickly weary of this excessive cold
 “ Place, and drawn up again, we continued our
 “ Descent from the Mountains by the same Passages.
 “ we went up the Day before, and so about five in
 “ the Evening arrived at *Oratava*, from whence we
 “ we set forth, our Faces so red and sore, that to
 “ cool them, we were forced to wash and bath them
 “ in Whites of Eggs, &c.

“ The whole Height of the *Pico* in perpendicular
 “ is vulgarly esteem’d to be two Miles and a half. No
 “ Trees, Herbs, or Shrubs in all the Passage but Pines,
 “ and amongst the whiter Sands a kind of Broom,
 “ being a bushy Plant; and at the side where we lay
 “ all Night, a kind of *Cordon*, which hath Stems of
 “ eight Foot high, the Trunk near half a Foot thick,
 “ every Stem growing in four Squares, and emerging
 “ from the Ground like Tuffets of Rushes; upon the
 “ Edges of these Stems grow very small red Buttons
 “ or Berries, which being squeezed produced a poi-
 “ sonous

“ sonous Milk, which lighting upon any Part of a
 “ Horse, or other Beast, fetches off the Hair from
 “ the Skin immediately; of the dead Part of this
 “ we made our Fires all Night. This Plant is also
 “ universally spread over the Island, and is perhaps a
 “ Kind of *Euphorbium*.

“ Of the Island *Teneriffe* itself, this Account was
 “ given by a judicious and inquisitive Man, who liv’d
 “ twenty Years in it as a Physician and Merchant.
 “ His Opinion is, that the whole Island being a Ground
 “ mightily impregnated with Brimstone, did in for-
 “ mer Times take Fire, and blow up all or near upon
 “ all at the same Time, and that many Mountains of
 “ huge Stones calcin’d and burnt, which appear every
 “ where about the Island, especially in the South-
 “ west Parts of it, were rais’d and heav’d up out of
 “ the Bowels of the Earth, at the Time of that ge-
 “ neral Conflagration; and that the greatest Quanti-
 “ ty of this Sulphur lying about the Center of the
 “ Island, rais’d up the *Pico* to that Height at which
 “ it is now seen. And he says that any one upon the
 “ Place that shall carefully note the Situation and
 “ Manner of these calcin’d Rocks how they lye, will
 “ easily be of that Mind: For he says, that they lye
 “ for three or four Miles almost round the Bottom of
 “ the *Pico*, and in such Order one above the other
 “ almost to the very *Sugar Loaf* (as ’tis called) as if
 “ the whole Ground swelling and rising up together
 “ by the Ascension of the Brimstone, the Torrents
 “ and Rivers of it did with a sudden Eruption rowl
 “ and tumble them down from the rest of the Rocks,
 “ especially (as was said before) to the South-west:
 “ For on that side, from the very top of the *Pico* al-
 “ most

The HISTORY of

“ most to the Sea-shoar, lye huge Heaps of these burnt
 “ Rocks, one under another. And there remain to
 “ this time the very Tracts of the Rivers of Brim-
 “ stone, as they ran over all this Quarter of the Island,
 “ which hath so wasted the Ground beyond Recove-
 “ ry, that nothing can be made to grow there but
 “ Broom : But on the North side of the *Pico*, few or
 “ none of these Stones appear. And he concluded
 “ hence, that the *Volcanio* discharg’d itself chiefly to
 “ the South-west. He adds farther, that Mines of
 “ several Metals were broken and blown up at the
 “ same time. These calcin’d Rocks resembling some
 “ of them Iron-Oar, some Silver, and others Copper.
 “ Particularly at a certain Place in these South-west
 “ Parts called the *Azuleios*, being very high Moun-
 “ tains, where never any *English* Man but himself
 “ (that ever he heard of) was. There are vast Quan-
 “ tities of a loose blewish Earth intermixt with blue
 “ Stones, which have on them yellow Rust as that
 “ of Copper and Vitriol : And likewise many little
 “ Springs of vitriolate Waters, where he supposes was
 “ a Copper Mine. And he was told by a Bell-founder
 “ of *Oratava*, that out of two Horse Loads of this
 “ Earth, he got as much Gold as made two large
 “ Rings. And a *Portugueze* told him, who had been
 “ in the *West-Indies*, that his Opinion was, there were
 “ as good Mines of Gold and Silver there as the best
 “ in the *Indies*. There are likewise hereabout ni-
 “ trous Waters and Stones covered with a deep Saf-
 “ fron-colour’d Rust, and tasting of Iron. And far-
 “ ther he mentions a Friend of his, who out of two
 “ Lumps of Earth or Oar, brought from the top of
 “ this side the Mountain, made two Silver-spoons. All
 this

“ this he confirms from the late Instance of the *Palme*
 “ Island eighteen Leagues from *Tenariffa*, where a
 “ *Volcanio* was fired about twelve Years since ; the
 “ Violence whereof made an Earthquake in this Island
 “ so great, that he and others ran out of their Houses,
 “ fearing they would have fallen upon their Heads.
 “ They heard the Noise of the Torrents of flaming
 “ Brimstone like Thunder, and saw the Fire as plain
 “ by Night, for about six Weeks together, as a Candle
 “ in the Room : And so much of the Sand and Ashes,
 “ brought from thence by the Wind with Clouds,
 “ fell on his Hat, as fill’d a Sand Box for his Ink-
 “ horn.

“ In some Part of this Island there grows a crooked
 “ Shrub which they call *Legnan*, which they bring
 “ for *England* as a sweet Wood : There are likewise
 “ Apricots, Peaches, &c. in Standard, which bear
 “ twice a Year, Pear-trees also which are as pregnant :
 “ Almonds of a tender Shell ; Palms, Plantains, Oranges
 “ and Limons, especially the *Pregnadas* which
 “ have small ones in their Bellies, from whence they
 “ are so denominated. Also they have Sugar-Canes,
 “ and a little Cotton. *Colloquintida* &c. The Roses
 “ blow at *Christmas*. There are good Carnations, and
 “ very large ; but Tulips will not grow or thrive
 “ there : Sampier cloaths the Rocks in Abundance,
 “ and a kind of Clover the Ground. Another Grass
 “ growing near the Sea, which is of a broader Leaf,
 “ so luscious and rank, as it will kill a Horse that eats
 “ of it, but no other Cattle. Eighty Ears of Wheat
 “ have been found to spring from one Root, but it
 “ grows not very high. The Corn of this is transpa-
 “ rent and bright like to the purest yellow Amber, and
 “ one

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“ one Bushel hath produc'd one hundred and thirty
 “ in a seasonable Year.

“ The Canary Birds (which they bring to us in
England) breed in the *Barancos* or *Gills*, which
 “ the Water hath fretted away in the Mountains, be-
 “ ing Places very cold. There are also Quails, Par-
 “ tridges, larger than ours and exceeding beautiful,
 “ great Wood-pigeons, Turtles at Spring, Crows,
 “ and sometimes from the Coast of *Barbary* appears
 “ the Falcon. Bees are carried into the Mountains,
 “ where they prosper exceedingly.

“ They have wild Goats on the Mountains, which
 “ climb to the very top of the *Pico* sometimes: Also
 “ Hogs and Multitudes of Conies.

“ Of Fish they have the Cherna, a very large and
 “ excellent Fish, better tasted than any we have in
 “ *England*; the Mero, Dolphin, Shark, Lobsters
 “ without the great Claws, Muscles, Periwinkles,
 “ and the Clacas, which is absolutely the very best
 “ Shell-fish in the World; they grow in the Rocks
 “ five or six under one great Shell, through the top
 “ Holes whereof they peep out with their Nebs,
 “ from whence (the Shells being broken a little more
 “ open with a Stone) they draw them forth. There
 “ is likewise another Fish like an Eel, which hath
 “ six or seven Tails of a Span in Length united to
 “ one Head and Body, which is also as short. Be-
 “ sides these, they have Turtles and Cabridos which
 “ are better than our Trouts.

“ The Island is full of Springs of pure Water tast-
 “ ing like Milk. And in *Lalaguna* (where the Wa-
 “ ter is not altogether so limpid and clear (they per-
 “ colate it through a kind of spongy Stone cut in
 “ Form of a Basin.

“ The

“ The Vines which afford those excellent Wines,
 “ grow all about the Island within a Mile of the Sea,
 “ such as are planted farther up are nothing esteem’d,
 “ neither will they thrive in any of the other Islands.
 “ For the *Guanchios* or antient Inhabitants he
 “ gives this full Account.

“ *September* the third, about twelve Years since, he
 “ took his Journey from *Guimar* (a Town inhabited
 “ for the most Part by such as derive themselves
 “ from the old *Guanchios*) in the Company of some
 “ of them, to view their Caves and the Bodies buried
 “ in them. This was a Favour they seldom or never
 “ permit to any (having in great Veneration the Bo-
 “ dies of their Ancestors, and likewise being most
 “ extremely against any Molestation of the Dead)
 “ but he had done several *elemosynary* Cures a-
 “ mongst them (for they are generally very poor, yet
 “ the poorest thinks himself too good to marry with
 “ the best *Spaniard*) which indeared him to them
 “ exceedingly; otherwise it is Death for any Stranger
 “ to visit these Caves or Bodies.

“ These Bodies are sowed up in Goat-skins with
 “ Thongs of the same, with very great Curiosity, par-
 “ ticularly in the incomparable Exactness and Even-
 “ ness of the Seams, and the Skins are made very loose
 “ and fit to the Body. Most of these Bodies are in-
 “ tire, the Eyes closed, Hair on the Head, Ears, Nose,
 “ Teeth, Lips, Beard, all perfect, only discoloured and
 “ a little shrivel’d, likewise the *Pudenda* of both Sexes;
 “ He saw about three or four hundred in several
 “ Caves, some of them are standing, others lie on Beds
 “ of Wood, so hardned by an Art they had (which the
 “ *Spaniards* call *Curar*, to cure a piece of Wood) as

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“ no Iron can pierce or hurt it. He says, that one Day
 “ being hunting a Ferret (which is much in use there)
 “ having a Bell about his Neck, ran after a Coney in-
 “ to a Hole, where they lost the Sound of the Bell;
 “ the Owner being afraid he should lose his Ferret,
 “ seeking about the Rock and Shrubs, found the
 “ Mouth of a Cave, and entring in, was so affrighted,
 “ that he cried out. It was at the Sight of one of
 “ these Bodies, very tall and large, lying with his Head
 “ on a great Stone, his Feet supported with a little
 “ Wall of Stone, the Body resting on a Bed of Wood
 “ (as before was mention’d.) The Fellow being now
 “ a little out of his Fright entred in, and cut off a
 “ great Piece of the Skin that lay on the Breast of this
 “ Body, which, the Doctor says, was more flexible
 “ and pliant than ever he felt any Kids-leather Glove,
 “ yet so far from being rotten, that the Man used it
 “ for his Flail many Years after.

“ These Bodies are very light, as if made up of
 “ Straw, and in some broken Limbs he observ’d the
 “ Nerves and Tendons, and also some Strings of the
 “ Veins and Arteries very distinctly.

“ His great Care was to enquire of these People
 “ what they had amongst them of Tradition con-
 “ cerning the Embalming and Preservation of these
 “ Bodies: from some of the eldest of them (above
 “ a hundred and ten Years of Age) he received this
 “ Account, That they had of old one particular
 “ Tribe of Men that had this Arr amongst themselves
 “ only, and kept it as a thing sacred, and not to be
 “ communicated to the Vulgar: These mixt not with
 “ the rest of the Inhabitants, nor married out of their
 “ own Tribe, and were also their Priests and Ministers

of Religion : That upon the Conquest of the *Spaniards* they were most of them destroy'd, and the Att lost with them, only they held some Traditions yet of a few Ingredients, that were made use of in this Business. They took Butter of Goats Milk (some said Hogs Grease was mingled with it) which they kept in the Skins for this purpose; in this they boiled certain Herbs; first a sort of wild Lavender, which grows there in great Quantities on the Rocks: Secondly, an Herb called *Lara*, of a very gummy and glutinous Consistence, which now grows there under the Tops of the Mountains only: Thirdly, a kind of *Cyclamen* or Sow-bread: Fourthly, wild Sage, growing plentifully in this Island: These with others bruised and boiled in the Butter, render'd it a perfect Balsam. This prepared, they first unbowelled the Corps (and in the poorer sort, to save Charges, they took out the Brain behind, and these poor were also sew'd up in Skins with the Hair on, whereas the richer sort were, as was said before, put up in Skins so finely and exactly dressed, as they remain most nearly pliant and gentle to this Day.) After the Body was thus ordered, they had in Readiness a *Lixivium* made of the Bark of Pine-trees, with which they wash'd the Body, drying it in the Sun in Summer, and in Stoves in Winter, this repeating very often. Afterward they began their *Uction* with the Balsam, both without and within, drying it again as before. This they continued till the Balsam had penetrated into the whole Habit, and the Muscles in all parts appeared through the contracted Skin, and the Body became exceeding light: Then they sew'd them

“ up in the Goat-skins, as was mention'd already.
 “ He was told by these antient People, that they
 “ have above twenty Caves of their Kings and great
 “ Persons, with their whole Families, yet unknown
 “ to any but themselves, and which they will never
 “ discover. Lastly, he says, that Bodies are found
 “ in the Caves of the *Grand Canaria* in Sacks, and
 “ quite consumed, not as these in *Teneriffa*. Thus far
 “ of the Bodies and embalming.

“ Anciently when they had no Knowledge of Iron,
 “ they made their Lances of Wood hardned as be-
 “ fore, some of which the Doctor hath seen. He hath
 “ also seen Earthen-pots so hard, that they cannot be
 “ broken ; of these some are found in the Caves and
 “ old *Bavances*, and used by the poorer People that
 “ find them, to boil Meat in. Likewise they had *Cu-
 ror* Stone itself, that is to say, a Kind of Slate called
 “ now *Tobona*, which they first formed to an Edge or
 “ Point as they had Occasion to use it, either as Knives
 “ or Lancets to let Blood withal.

“ Their Food is Barley roasted, and then ground
 “ with little Mills, which they made of Stone, and
 “ mixt with Milk and Honey : This they still feed
 “ on, and carry it on their Backs in Goat-skins.

“ To this Day they drink no Wine, nor care for
 “ Flefh. They are generally very lean, tall, active
 “ and full of Courage.

“ He himself hath seen them leap from Rock to
 “ Rock, from a very prodigious Height, till they
 “ came to the Bottom, sometimes making ten Fathom
 “ deep at one leap.

“ The manner is thus :

“ First they *teretate* their Lance (which is about
 “ the

“ the Bigness of a half Pike) that is, they poise it
 “ in their Hand, then they aim the Point of it at any
 “ Piece of a Rock, upon which they intend to light
 “ (sometimes not half a Foot broad.) At their going
 “ off they clap their Feet close to the Lance, and so
 “ carry their Bodies in the Air. The Point of the
 “ Lance first comes to the Place, which breaks the
 “ Force of their Fall; then they slide gently down
 “ by the Staff, and pitch with their Feet upon the
 “ very place they first designed, and from Rock to
 “ Rock till they come to the Bottom. Their
 “ Novices sometimes break their Necks in learn-
 “ ing.

“ He added several Stories to this Effect of their
 “ great Activity in leaping down Rocks and Cliffs.
 “ And how twenty eight of them made an Escape
 “ from the Battlements of an extraordinary high
 “ Castle in the Island, when the Governor thought
 “ he had made sure of them.

“ He told also (and the same was seriously con-
 “ firm'd by a *Spaniard*, and another *Canary Mer-*
 “ *chant* then in the Company.) That they whistle so
 “ loud as to be heard five Miles off: And that to be
 “ in the same Room with them when they whistle,
 “ were enough to indanger breaking the *Tympanum*
 “ of the Ear, and added; that he (being in Compa-
 “ ny of one that whistled his loudest) could not hear
 “ perfectly for fifteen Days after, the Noise was so
 “ great.

“ He affirms also, That they throw Stones with a
 “ Force almost as great as that of a Buller, and
 “ now use Stones in all their Fights as they did
 “ anciently.

When

When my *Reader* shall behold this large Number of *Relations*; perhaps he will think, that too many of them seem to be incredible *Stories*, and that if the *Royal Society* shall much busy themselves, about such wonderful and uncertain *Events*, they will fall into that Mistake, of which I have already accus'd some of the *Antients*, of framing *Romances*, instead of solid *Histories* of Nature. But here, though I shall first confirm what I said before, that it is an unprofitable, and unsound Way of *Natural Philosophy*, to regard nothing else, but the prodigious and extraordinary *Causes* and *Effects*; yet I will also add, that it is not an unfit Employment for the most judicious *Experimenter*, to examine and record the most unusual and monstrous Forces, and Motions of *Matter*. It is certain that many things, which now seem *miraculous*, would not be so, if once we come to be fully acquainted with their *Compositions* and *Operations*. And it is also as true, that there are many *Qualities*, and *Figures*, and *Powers* of things, that break the common Laws, and transgress the standing Rules of *Nature*. It is not therefore an Extravagance, to observe such *Productions*, as are indeed *admirable* in themselves, if at the same time we do not strive to make those appear to be *admirable*, that are groundless and false. In this there is a near Resemblance between *Natural* and *Civil History*. In the *Civil*, that way of *Romance* is to be exploded, which heightens all the Characters and Actions of Men, beyond all Shadow of *Probability*; yet this does not hinder, but the great and eminent *Virtues* of extraordinary Men of all Ages, may be related and propos'd to our Example. The same is to be affirm'd of *Natural History*. To make that only to consist of strange and delightful Tales, is to render it nothing

nothing else but *vain* and *ridiculous Knight-Errantry*. Yet we may avoid that Extreme, and still leave room to consider the singular and irregular *Effects*, and to imitate the unexpected and monstrous *Excesses*, which *Nature* does sometimes practise in her *Works*. The first may be only compar'd to the Fables of *Ama-dis*, and the *Seven Champions*; the other to the real *Histories* of *Alexander*, *Hannibal*, *Scipio*, or *Cæsar*: in which though many of their Actions may at first surprize us; yet there is nothing that exceeds the *Truth* of *Life*, and that may not serve for our *In-struction*, or *Imitation*.

If this Way of general receiving all credible Ac-
counts of *Natural*, and *Artificial Productions*, shall
seem expos'd to overmuch Hazard and Uncertainty: that Danger is remov'd by the *Royal Society's* reduc-
ing such Matters of Hear-say and Information, into
real and impartial *Trials*, perform'd by their own
Hands: Of the Exactness, Variation and accurate
Repetition of their *Experiments*, I have already dis-
cours'd: I will now go on to lay down in short Com-
pass those Parts of the visible World, about which
they have chiefly bestow'd their *Pains*.

Sect. XXXIII.
The Experi-
ments they
have try'd.

The first Kind that I shall mention, is of *Experi- Of Fir,*
ments about *Fire*, and *Flame*, of these many were
made in order to the Examination of a *Theory* pro-
pounded to them, that there is no such thing, as an
elementary Fire of the *Peripatetics*; nor *fiery Atoms*
of the *Epicureans*: but that *Fire* is only the Act of the
Dissolution of heated *sulphureous Bodies*, by the *Air*
as a *Menstruum*, much after the same manner as *Aqua*
Fortis, or other sharp *Menstruums* do work on disso-
luble

The HISTORY of

luble Bodies, as *Iron, Tin, Copper* : that Heat and Light are two inseparable Effects of this Dissolution, as Heat and Ebullition are of those Dissolutions of *Tin, and Copper* : that *Flame* is a Dissolution of *Smoak*, which consists of combustible Particles, carried upward by the Heat of rarified *Air* : and that *Ashes* are a Part of the *Body* not dissoluble by the *Air*.

Of this Sort, they have made *Experiments*, to find the lasting of the burning of a Candle, Lamp, or Coals, in a cubic Foot of common, rarified, and *condens'd Air* : to exhibit the sudden Extinction of Candles, Lamps, and lighted Coals, when they are put into *satiated Air* : to shew the speedy Extinction of kindled Charcoals, by blowing on them with Bellows, that *Air* which had before been satiated with burning : to shew that the greatest and most lasting Heat, without a Supply of fresh *Air*, is unable to burn Wood, Sulphur, and most other combustible Matters : to find the comparative Heat of all Kinds of *Fires*, and *Flames* of several Materials, as of Sulphur, Camphire, Spirit of Wine, Oyl, Wood, Coal, Seacoal, Iron : to find at what Degree of Heat, Lead, Tin, Silver, Brass, Copper, Gold will melt.

Experiments of the Transparency, and Refractedness of *Flames* : of discerning the Strength of several Kinds of Gunpowder, *Pulvis Fulminans, Aurum Fulminans* : of Gunpowder in the exhausting Engine : of bending Springs by the Help of Gunpowder : of melting Copper immediately, by the Help of a Fluxpowder : of the recoyling of Guns.

Experiments of Candles, and Coals, extinguish'd by the Damps of a deep Well : of the burning of Lamps under Water : of burning Spirit of Wine and Camphire together, and the Diversity of their *Flames* : of
reducing

reducing Copper to a very combustible Substance: of heating the *Air*, by blowing it through a red-hot earthen *Pipe*, so as to burn Wood: of the Brightness of the *Flame* of *Niter* and *Sulphur*: of the burning and flaming of Tin Filings by the Help of *Niter*: of kindling Bodies, in common rarified and condens'd *Air*, by the Help of a *Burning-glass*: of the comparative Heat cast by a *Burning-glass*, in the Morning, and at Noon: of burning with a *Lens* made of Ice: of calcining *Antimony* in the Sun with Loss: to find whether *Aurum Fulminans* or *Putris Fulminans* do flame upon *Explosion*: of hatching *Eggs* with a Lamp Furnace.

Their second Sort of *Experiments* is of those that *Of Air.* have been made in order to find out the Nature, Properties, and uses of *Air*: Such as these.

Experiments for determining the Height of the *Atmosphere*, for finding the Pressure of the *Atmosphere*: on the Tops of Mountains, on the Surface of the Earth, and at the Bottoms of very deep Pits and Mines, by the Help of *Quick-silver*, and other Contrivances: for finding the Pressure of the *Atmosphere*, both in the same Place, and Places very far remov'd.

Experiments to determine the possible Bounds of Expansion and Condensation of the *Air*, by Heat and Cold, by exhausting and compressing: to determine the Strength of *Air* under the several Degrees of *Rarefaction* and *Condensation*: of the Force of condens'd *Air* in Wind-Guns, to state the comparative Gravity of the *Air* to other fluid and solid Bodies: to discover the refractive Power of the *Air*, under the several Degrees of *Rarefaction* and *Condensation*: to manifest the inflective Veins of the *Air*: to produce a Kind of Opacity of the *Air*: of the falling of Smoak in rari-

ried *Air*: to make *Glass Bubbles* swim in *Air* very much condens'd: of *Glass-balls* rising in a heavy or condens'd *Air*, and falling in a lighter and more rarified.

Experiments of the Propagation of Sounds through common rarified and condens'd *Air*: of the Congruity or Incongruity of *Air*, and its Capacity to penetrate some Bodies, and not others: of generating *Air* by corrosive *Mensstruums* out of fermenting Liquors, out of *Water* and other Liquors, by Heat and by Exhaustion: of the returning of such *Air* into the *Water* again: of the vanishing of *Air* into *Water* exhausted of *Air*: of the maintaining and increasing a *Fire* by such *Airs*: of the Fitness and Unfitness of such *Air* for Respiration: of the Use of *Air* in breathing.

Experiments of keeping Creatures many Hours alive, by blowing into the *Lungs* with Bellows, after that all the *Thorax* and *Abdomen* were open'd and cut away, and all the Entrails, save the *Heart* and *Lungs*, remov'd: of reviving *Chickens*, after they have been strangled, by blowing into their *Lungs*: to try how long a Man can live, by expiring and inspiring again the same *Air*: to try whether the *Air* so respired, might not by several Means be purified or renew'd: to prove that it is not the Heat nor the Cold of this respired *Air*, that choaks.

Experiments of the respiring of *Animals* in *Air* much rarified, and the fatal Effects: of the long Continuance of several *Animals* very well in *Air* as much condens'd, as it will be under *Water*, at two hundred Fathoms deep, that is about eight times: of the Quantity of fresh *Air* requisite for the Life of a respiring *Animal*, for a certain Space of Time: of making *Air* unfit for Respiration, by satiating it, by suffering Candles,

dles or Coals to burn in it, till they extinguish themselves.

Experiments of including living *Animals*, and kindled Coals, and Candles, in a large Glass, to observe which of them will be first extinguish'd : of a Man's living half an Hour, without any Inconvenience, in a *Leaden Bell*, at diverse Fathoms under Water : of the Quantity of *Air* respir'd at once by a Man : of the Strength a Man has to raise Weights by his Breath.

Experiments of the swelling of an Arm put into the rarifying Engine, by taking off the Pressure of the *Ambient Air* : of the swelling of Vipers and Frogs, upon taking off the Pressure of the *Ambient Air* : of the Life, and free Motion of Fishes in Water, under the Pressure of *Air* eight Times condens'd : of Insects not being able to move in exhausted *Air* : of the Resistance of *Air* to Bodies mov'd through it : of the not growing of Seeds for want of *Air* : of the growing of Plants hung in the *Air*, and of the Decrease of their Weight : of the living of a Cameleon, Snakes, Toads, and diverse Insects, in a free *Air*, without Food : of conveying *Air* under Water to any Depth : of condensing *Air* by *Water*, and by the Expansion of freezing *Water* : of the swelling of *Lungs* in the rarifying Engine : of the Velocity and Strength of several *Winds*.

The third Kind, are those which have been made Of *Water*, about the Substance and Properties of *Water* : Such are,

Experiments about the comparative Gravity of *salt Water* and *fresh*, and of several *Medicinal Springs* found in this Nation : of the different Weight of the *Sea-water*, in several Climates, and at several Seasons :

The HISTORY of

of the Weight of *Distill'd-water*, *Snow-water*, *May-dew*, *Rain-water*, *Spring-water* : of augmenting the Weight of *Liquor*, by dissolving *Salts* : of the greater Thickness of such *Water* at Bottom than at the Top : of weighing ascending and descending Bodies in *Water* ; of the Pressure of the *Water* at several Depths under its Surface.

Experiments of the Heat and Cold of the *Water*, at several Depths of the *Sea* : of propagating Sounds through the *Water* : of sounding the Depth of the *Sea* without a Line : of fetching up *Water* from the Bottom of the *Sea*, of fetching up Earth, Sand, Plants, from the Bottom of the *Sea*.

Experiments of the Resistance of *Water* to Bodies mov'd on its Surface, of several Figures, and by several Degrees of Force : of the Resistance of *Water* to Bodies mov'd through its Substance, ascending and descending : of the Expansion and Condensation of *Water* by Heat and Cold : of the Condensation of *Water* by several Ways of Pressure : of converting *Water* into a vaporous *Air*, lasting some time in that Form : the *Torricellian Experiment* tried with *Water* in a *Glass-Cane* thirty six and forty Foot high, in a leaden *Tube* also with a *Glass* at the Top : the same tried with Oil, and other *Liquors*.

Experiments of the rising of *Water* in small *Tubes*, and many others about its Congruity : of Filtration, or of the rising of *Water* to a great Height in Sand, &c. of the swimming of *Fishes* : of *Water's* being able to penetrate through those Pores, where *Air* will not : of opening Bellows at a Depth under *Water*, and blowing up *Bladders*, to find the Pressure of the *Water* : of *Water* not subsiding in a high *Glass-Cane* upon removing the ambient Pressure, after it had been well exhausted :

hausted of the *Air-bubbles* that lurk'd in it: of forcing *Water* out of a Vessel by its own Vapours.

Experiments of the different Weight and Refraction of warm *Water* and cold; of the passing of *Water* through the Coats of a Man's Stomach; of the living of Fish in *Water*, the *Air* being exhausted; of closing up a Fish in a Glass of *Water*; of the dying of Fishes in *Water*, upon taking off the Pressure of the *Air*, in the rarifying Engine; of *Hydrostaticks*, and making a Body sink by pouring more *Water* upon it; of raising *Water* above its Standard by sucking; of the subsiding of *Water* in the Stem, upon putting the Bolt-head into warm *Water*; of the shrinking of *Water* upon cooling.

The fourth Kind are about *Mines, Metals, Oars, Of Metals, Stones, &c.* Such as *and Stones.*

Experiments of *Coppelling* made at the Tower; of dissolving many Salts in one Liquor; of the *Oculus Mundi*; of *Rusma*; of the Tenacity of several *Metals* examin'd by Weights; of the Rarefaction and Condensation of Glass; of the volatifying *Salt of Tartar*, with burnt Alom, with Vinegar and Spirit of Wine; on the *Bononian Stone*; on *Diamonds*, of their shining by rubbing; on *Copper-Oar*; of the Distillation of *Coal*; of refining several Kinds of *Lead-Oar*; of extracting a much greater Quantity of *Silver* out of that *Oar*, than is commonly done; of several Ways of reducing *Letharges* into *Lead*; of changing *Gold* into *Silver*.

Experiments Magnetical, of the best Form of caping *Loadstones*; of the best Forms of *Needles*; of several Lengths and Bignesses: of various Ways of touching *Needles* on the *Loadstone*; of making the same

The HISTORY of

same Pole of the *Loadstone* both attract and chase the same End of the *Needle*, without touching it; to find the Variation of the *Loadstone* here at *London*.

Experiments with the dipping *Needle*; of the extraordinary Strength in Proportion to its Bulk of a small *Loadstone*; to measure the Strength of the *Magnetical* attractive Power, at several Distances from the *Stone*: to examine the Force of the attractive Power, through several *Mediums*, as Water, Air, Wood, Lead, and Stone; to divert the attractive Power, by interposing Iron; to find the directive Virtue of the *Loadstone* under Water.

Experiments to manifest, by the Help of Steel-dust, the Lines of the directive Virtue of the *Loadstone* to be oval, in a contrary Position to what *Des Cartes's Theory* makes them; to manifest those Lines of Direction by the Help of *Needles*; to discover those Lines of Direction, when the Influence of many *Loadstones* is compounded; to find what those Lines are encompassing a *Spherical Loadstone*, what about a Square, and what about a regular Figure; to bore through the *Axis* of a *Loadstone*, and fill it up with a *Cylindrical Steel*: *Experiments* on *Loadstones* having many Poles, and yet the *Stones* seeming uniform.

Of Vegetables.

The fifth Kind is of the Growth of *Vegetables* in several Kinds of Water; as *River-water*, *Rain-Water*, *Distill'd Water*, *May-Dew*; of hindring the Growth of Seed-Corn in the Earth, by extracting the Air, and furthering their Growth, by admitting it; of steeping Seeds of several Kinds; of inverting the Positions of *Roots* and *Plants* set in the Ground, to find whether there are Valves in the Pores of the Wood, that only open one Way; of the Decrease of the Weight of

of *Plants* growing in Air; of *Lignum Fossile*; of the growing of some Branches of *Rosemary*, by only sprinkling the leaves with Water; of *Camphire Wood*; of Wood brought from the *Canaries*; of a stinking Wood brought out of the *East-Indies*; of the Re-union of the *Bark* of *Trees* after it had been separated from the *Body*.

The sixth are *Experiments Medicinal* and *Anato-^{Medicinal} mical*; as of cutting out the Spleen of a Dog; of the Effects of Vipers biting Dogs; of a *Camaleon*, and its ^{and Anato-} *Dissection*; of preserving *Animals* in Spirit of Wine, Oil of Turpentine, and other Liquors; of injecting various Liquors, and other Substances into the Veins of several Creatures.

Experiments of destroying *Mites* by several Fumes; of the equivocal Generation of *Insects*; of feeding a *Carp* in the Air; of making Insects with Cheese, and Sack; of killing Water-Newts, Toads, and Slowworms with several Salts; of killing Frogs, by touching their Skin with Vinegar, Pitch, or Mercury; of a Spider's not being enchanted by a Circle of *Unicorn's Horn*, or *Irish Earth*, laid round about it.

Experiments with a poison'd *Indian Dagger* on several *Animals*; with the *Maccassar Poison*; with *Florentine Poison*, and several *Antidotes* against it; of making Flesh grow on, after it has been once cut off; of the grafting a *Spur* on the Head of a *Cock*, and its growing; of the living of Creatures by factitious Air; of the reviving of *Animals* strangled, by blowing into their *Lungs*; of Flesh not breeding Worms, when secur'd from Fly-blowing; of the Suffocation of *Animals* upon piercing the *Thorax*; of hatching Silk-Worm's Eggs in rarified Air; of transfusing the Blood of one *Animal* into another.

The

Of sensible
Qualities.

The seventh Sort are about those which are call'd *sensible Qualities*; as of Freezing; of Cold, and Heat; of freezing Water freed from Air; of the Time and Manner of the Contraction in freezing luke-warm Water; of the Temperature of several Places, by seal'd *Thermometers*; as of several Countries; of the Bottoms of deep Mines, Wells, Vaults, on the Tops of Hills, at the Bottom of the Sea.

Experiments on the Contraction of Oil of *Vitriol*; and diverse other Oils by *freezing*; of *freezing* bitter Tinctures; of *freezing* several ting'd Liquors, and driving all the Tincture inward to the Center; of shewing Ice to be capable of various Degrees of Cold, greater than is requisite to keep it Ice; of producing Cold by the Dissolution of several Salts; of *freezing* Water without *Blebs*; of a membranous Substance separable from the Blood by *freezing*; of a *Thermometer* in rarified and condens'd Air; of very easy *freezing* of Oil of Aniseeds; of making a Standard of Cold by *freezing* distill'd Water.

Of other
Qualities.

The eighth are of *Rarity, Density, Gravity, Pressure, Levity, Fluidity, Firmness, Congruity, &c.* as of the Nature of *Gravity*; of the Cohesion of two flat Marbles; of compressing the Air with *Mercury* to find its Spring; of the Weights of Bodies, solid and fluid; of Rarefaction and Condensation by the Help of *Mercury*; of the Tenacity of several Bodies; of the turning of two very fluid Liquors into one solid Mass, by mingling them together.

Experiments for examining, whether the Gravity of Bodies alter, according as they are carried a good Way above or below the Surface of the Earth; of the

standing of *Mercury* well exhausted, many Inches, nay many Feet, above its usual standing; of a *Wheel-Barometer*, of the Expansion, and Contraction of Glass and Metals by Heat and Cold; of Spirit of Wine, and several ting'd Liquors, by the Help of a Glass Tube; the Examination of *Monsieur Paschal's* Experiment by many others.

The ninth are *Experiments of Light, Sound, Colours, Taste, Smell*; as of two transparent Liquors producing an opacous one: of Echoes and reflected Sounds; of musical Sounds and Harmonies; of Colours; of the greater Refraction of Water than of Ice; of Refraction in a new Engine; of the Refraction of Glass of various Shapes under Water; of destroying the shining of Fish by Oil of *Vitriol*; of making a great Light by rubbing two Chrystals hard one against the other; of making a *deaf* and *dumb* Man to speak. Of Light, Sound, &c.

The tenth are *Experiments of Motion*: as of Glass Drops several Ways order'd and broken; of the Velocity of the Descent of several Bodies of diverse Fashions through several Liquors; of determining the Velocity of Bodies falling through the Air, tried by many Ways; of the *swift Motion* of Sounds; of the irregular *Motion* of the Oil of Turpentine on Spirit of Wine; of the Strength of falling Bodies, according to the several Heights, from which they fall; of proportioning the Shapes of Bodies, so as to make them fall together in the same Time through differing *Mediums*. Of Motion.

Experiments of the Swiftneſs of a Bullet ſhot with extraordinary Powder; of the beſt Figure of the Weight

Weight of a *Pendulum* for *Motion*; of the *Motion* of pendulous Bodies of various Figures; to determine the Length of *Pendulums*, to find the Velocity of the Vibrations of a sounding String; to find the Velocity of *Motion*, propagated by a very long extended Wire; for explaining the Inflection of a strait Motion into a circular, by a supervening attractive Power towards the Center, in order to the explaining of the *Motion* of the Planets.

Experiments of the circular and complicated *Motion* of *Pendulums*, to explain the *Hypothesis* of the Moon's moving about the Earth; of comparing the *Motions* of a circular *Pendulum*, with the *Motion* of a strait one; of the Propagation of *Motion* from one Body to another; of the Reflection of *Motion*; of the vibrating *Motion* of *Quicksilver* in a crooked Pipe, imitating the *Motion* of a *Pendulum*; of communicating of the Strength of Powder for the bending of Springs; and thereby for making artificial Muscles, to command what Strength we desire.

*Chymical
and Mechanical.*

The eleventh are *Experiments Chymical, Mechanical, Optical*; as of reducing the Flesh of Animals into a Liquor like Blood, by dissolving it in a certain *Menstruum*; of a great Facility of raising Water in Pipes of a large Bore; of brewing Beer with Bread, Barley, Oats, Wheat, and without melting; of precipitating Tartar out of *Wine* by several Expedients; of a *chymical* Extraction of a volatile Spirit, and Salt out of Spunges; of examining *Aurum fulminans* after Explosion; of the Dissolution of *Manna* in Water, and of a chrySTALLISING it again out of it, by Evaporation.

Expe-

Experiments of *volatifying* Salt of *Tartar* many Ways; of examining the *mucilaginous* Matter call'd *Star-shoot*; of examining our *English Telescopes*, and *Microscopes*, and comparing them with such as have been made at *Rome*; of making a volatile Salt with Oil of *Turpentine*, and Sea-salt; of the Quantity of Spirits in *Cyder*; of the Strength of several Springs; of examining a Pump made with Bellows; of dying Silk with several *Jamaica* Woods; of finding the Strength of Wood of several Kinds, for bearing; of finding the Flexibility of various Woods, and determining the utmost Extent of their yielding and bending.

Experiments about the Gravity of Bodies made on the Top of *St. Paul's Steeple*, *Westminster Abby*, and several other high Places; and in a Well of seventy Fathoms Depth; examined about the *Virgula Divina*, wherein the common Assertions were found false; of the various Refractions of several Liquors, in a new refractive Engine of common Oil of *Tobacco*, made by Distillation in a Glass Retort; of making the Object Glass of a *Microscope* to bear as large an Aperture as is desir'd.

Of this their Way of Experimenting I will here produce these Examples.



EXPERIMENTS

Of the Weight of Bodies increased
in the FIRE:

*Made at the Tower, and the Account
brought in by my Lord BOUNCKER.*

1. Copper and Lead.

	d.	gr.
THE Copel weighed	10	8 $\frac{1}{2}$
Lead — — —	4	9
Copper — — —	0	6

Into the Fire all three — 14 23 $\frac{1}{2}$

Out of the Fire — 15 4 $\frac{1}{2}$

Gained — 0 5 $\frac{1}{2}$

*Besides what the Copel lost in Weight, supposed to
be about three Grains.*

2. Copper and Lead.

	d.	gr.
Copel — — —	10	2
Lead — — —	4	9 $\frac{1}{2}$
Copper — — —	0	6

Into the Fire all three — 14 17 $\frac{1}{2}$

Out of the Fire — 15 1 $\frac{1}{2}$

Gained — 0 7 $\frac{3}{4}$

3. Lead

3. Lead alone.

	d.	gr.
Copel — — —	10	3 $\frac{2}{3}$
Lead — — —	4	9
<hr/>		
Into the Fire both —	14	12 $\frac{2}{3}$
Out of the Fire — — —	14	3 $\frac{1}{2}$
<hr/>		
Gained —	0	10 $\frac{2}{3}$
<hr/>		

4. Lead alone.

	d.	gr.
Copel — — —	10	10 $\frac{2}{8}$
Lead — — —	4	9
<hr/>		
Into the Fire both —	14	19 $\frac{2}{8}$
Out of the Fire — — —	15	1 $\frac{2}{64}$
<hr/>		
Gained —	0	5 $\frac{1}{64}$
<hr/>		

5. Copel alone.

	d.	gr.
Into the Fire — — —	10	5
Out of the Fire — — —	10	1 $\frac{2}{8}$
<hr/>		
Lost —	0	3 $\frac{1}{8}$
<hr/>		

6. Copel alone.

	d.	gr.
Into the Fire —	10	wanting 7 $\frac{1}{4}$
Out of the Fire —	10	wanting 9
<hr/>		
Lost —	0	1 $\frac{1}{4}$
<hr/>		

The HISTORY of EXPERIMENTS

Of a Stone called

OCULUS MUNDI,

Made by Dr. GODDARD.

A Small Stone of the Kind, called by some Authors
Oculus Mundi, being dry and cloudy, weighed
————— 5 gr. $\frac{200}{176}$

The same being put under Water, for a Night and
somewhat more, became transparent, and the Super-
ficies being wiped dry, weighed ——— 6 gr. $\frac{176}{176}$

The Difference between these two Weights — 0. $\frac{176}{176}$

The same Stone kept out of Water one Day, and be-
coming cloudy again, weighed ——— 5. $\frac{222}{176}$
which was more than the first Weight ——— 0. $\frac{176}{176}$

The same being kept dry two Days longer, weigh-
ed ——— 5. $\frac{222}{176}$
which was less than at first ——— 0. $\frac{176}{176}$

Being put under Water for a Night, and becoming
again transparent, and wiped dry, the Weight was 6. $\frac{176}{176}$
the same with the first, after putting in Water, and more
than the last Weight, after keeping of it dry — 0. $\frac{176}{176}$

Being kept dry some time longer, it did not grow
sensibly lighter.

Another Stone, of the same Kind, being variegated
with milky, white, and grey, like some Sort of Agates,
while it lay under Water, was always invironed with
little Bubbles, such as appear in Water before boiling,
next the Sides of the Vessel.

There

There were also some of the like Bubbles on the Surface of the Water just over it; as if either some Exhalations came out of it, or that it did excite some Fermentation in the Parts of the Water contiguous to it.

There was little sensible Difference of Transparency in this Stone, before the putting under Water, and after: To be sure the milky white Parts continued as before, but more different in Weight than in the former. For whereas, before the putting into the Water, the Weight was — 18 gr. $\frac{1}{18}$ after it had lain in about twenty-four Hours, the Weight was 20 gr. $\frac{1}{18}$; so the Difference was — 1 gr. $\frac{1}{18}$.

The same Stone was infused in the Water scalding hot, and so continued for a while after it was cold, but got no more Weight, than upon infusing in the cold; neither was there any sensible Difference in the Weight both times.



An ACCOUNT of a Dog dissected, By Mr. H O O K.

IN Prosecution of some Inquiries into the Nature of Respiration in several Animals; a Dog was dissected, and by means of a Pair of Bellows, and a certain Pipe thrust into the Wind-pipe of the Creature, the Heart continued beating for a very long while after all the Thorax and Belly had been open'd, nay after the Diaphragm had been in great Part cut away, and the Pericardium remov'd from the Heart. And from several Trials made, it seem'd very probable, that this Motion might have been continued, as long almost as there was any Blood left within the Vessels of the Dog; for the Motion of the Heart seem'd very little chang'd, after above an Hour's time from the first displaying the Thorax; though we found, that upon removing the Bellows, the Lungs would presently grow flaccid, and the Heart begin to have convulsive Motions; but upon removing the Motion of the Bellows, the Heart recover'd its former Motion, and the Convulsions ceased. Though I made a Ligature upon all the great Vessels that went into the lower Parts of its Body, I could not find any Alteration in the Pulse of the Heart; the Circulation, it seems, being perform'd some other Way. I could not perceive any thing distinctly, whether the Air did unite and mix with the Blood; nor did in the least perceive the Heart to swell upon the Extension of the Lungs; nor did the Lungs seem to swell upon the Contraction of the Heart.

Fig: 1.

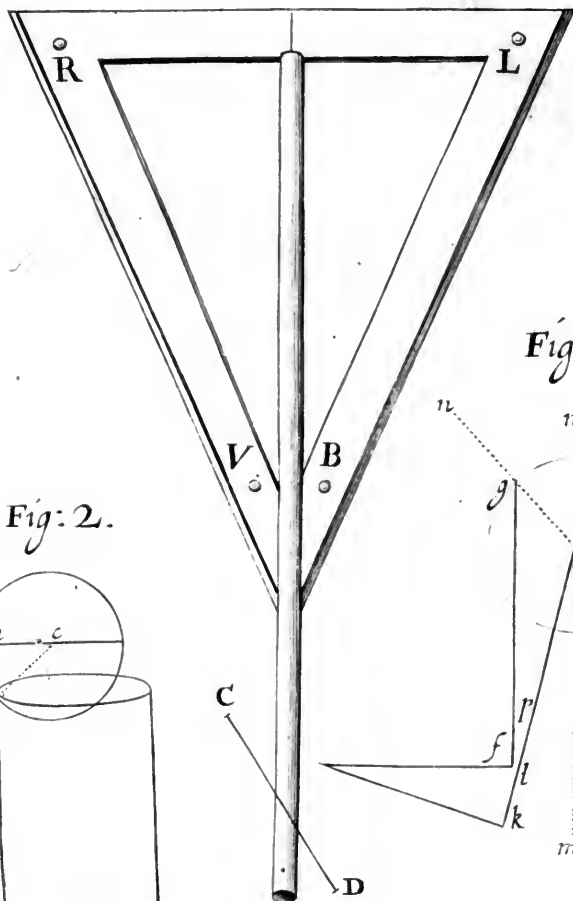


Fig: 2.

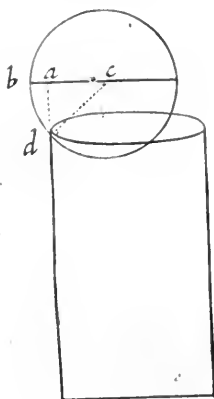
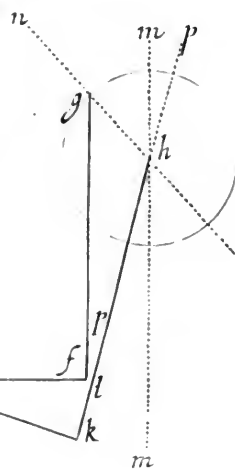


Fig: 3.



EXPERIMENTS

Of the Recoiling of

G U N S.

By the Lord B R O U N C K E R.

WHen I was commanded by this Society, to make some Experiments of the Recoiling of Guns: In order to the discovery of the cause thereof, I caused this Engine that lies here before you to be prepared, and with it (assisted by some of the most eminent of this Society) I had divers shots made in the Court of this College, near the length thereof from the mark, with a full charge (about a four-penny weight) of Powder; but without any other success, than that there was nothing regular in that way, which was by laying it upon a heavy Table, unto which it was sometimes fastned with Screws at all the four places R, L, V, B, sometimes only at R or L, having wheels affixed at L and V, or R and B, that it might the more easily recoil.

Fig. 1.

This uncertainty I did then conceive might arise from one or more of these three causes, viz.

1. The violent trembling motion of the Gun, whence the Bullet might casually receive some literal impulse from the nose of the Piece at the parting from it.
2. The yielding of the Table, which was sensible.
3. The difficulty of aiming well by the Sight and Button so far from the Mark.

G g

There-

Therefore to avoid all these, the Experiments I caus'd to be made before you in the Gallery of this Colledge, you may be pleased to remember were performed, first, taking only eight grains of Powder for the charge. Secondly, laying the Engine upon the Floor; and, Thirdly, aiming by a Thread at M, a Mark about an Inch and $\frac{1}{4}$ from the Mouth of the Gun (the edge of a knife being put for the Mark, the better to discern the line that was shot in) and they thus succeeded.

When the Piece was fastned to the Floor both at R and L, the Bullet then did so fully hit the Mark, that it was divided by it into two parts, whose difference in weight was less than ten grains (about the thirty third part of the whole Bullet) although the lesser part was a little hollow, and that from which the neck of Lead was a little too close pared off: But when hindred from Recoiling only at R, the Bullet mist the mark towards L or A, for the whole Bullet, less than two grains excepted, went on that side: And in like manner when hindred from Recoiling at L, the Bullet mist the Mark towards R or B, the whole Bullet, less than two grains excepted, passing the knife on that side thereof.

I had the honour to make other Experiments with the same Engine, lately at White-Hall, before his Majesty and his Highness Royal within the Tilt-yard Gallery, where there is the hearth of a chimney raised a little above the Floor, about the distance of thirteen feet from the opposite wall, against which I caused a plank to be placed, and the Engine to be laid first against the middle of the Hearth, that it might not recoil at all, and that part of the board to be marked against which 'twas levelled, known by a line stretch-
ed

ed from the Breech of the Piece unto the Board, directly over the sight and button; and the fire being given (the charge being but eight grains of Powder as before) the Bullet did fully hit the mark. Secondly, the Piece (charged and levelled in the same manner) was laid at the end of the Hearth next the Park, so that very little of the corner R rested against it, and then the Bullet miss'd the mark about an inch and a quarter towards the Park, or A. The like being done at the other end of the Hearth, the Bullet then miss'd the mark as much the other way; and afterwards with double that charge something more, as before I had found it less with a smaller charge.

Since this (at first designing only to experiment the several distances that the Bullet is carried wide of the mark with different charges of Powder) I made these Experiments following.

In the first Column whereof you have the corner stopt from recoiling.

In the second the grains of Powder with which the Piece was charged.

In the third the distance the Bullet was shot wide from the mark, in inches, tenths, and parts of tenths.

In the fourth the side on which the Bullet was carried.

In the last the distance of the mark from the muzzle of the Gun in feet.

B	16	O.		N	9	L	40	O.	$\frac{1}{4}$	L	9	L	12	I.	$\frac{1}{4}$	R	6
L	16	I.	$7\frac{1}{2}$	R	9	L	38	O.	$1\frac{1}{2}$	R	9	L	48	O.	$\frac{1}{4}$	R	$\frac{1}{4}$
R	16	I.	5	L	9	L	39	O.	$1\frac{1}{2}$	L	9	L	48	O.	$\frac{1}{4}$	L	2
R	12	I.	$5\frac{1}{2}$	R	9	L	39	O.	$1\frac{1}{2}$	L	9	L	48	O.	$\frac{1}{4}$	L	4
R	12	I.	$7\frac{1}{2}$	R	9	L	12	O.	$\frac{1}{4}$	L	9	L	48	O.	$\frac{1}{4}$	L	6
L	8	I.	6	R	9	L	12	I.	$\frac{1}{2}$	L	9	L	4	O.	$\frac{1}{2}$	R	$\frac{1}{4}$
R	8	I.	1	R	9	L	12	I.	$\frac{1}{2}$	L	9	L	4	O.	$\frac{1}{2}$	R	$\frac{1}{4}$
R	4	I.	0	R	9	L	12	I.	$\frac{1}{2}$	L	9	L	8	O.	$\frac{1}{2}$	R	$\frac{1}{4}$
L	4	I.	$1\frac{1}{4}$	R	9	L	12	I.	$\frac{1}{2}$	L	9	L	8	O.	$\frac{1}{2}$	R	$\frac{1}{4}$
L	24	I.	$1\frac{1}{2}$	R	9	L	12	O.	1	L	9	L	12	O.	$\frac{1}{4}$	R	$\frac{1}{4}$
L	32	O.	6	R	9	L	12	O.	3	L	9	L	16	O.	$\frac{1}{4}$	R	$\frac{1}{4}$
L	40	O.	$1\frac{1}{2}$	R	9	L	12	O.	$3\frac{1}{2}$	L	9	L	48	O.	0	N	9
L	48	O.	$4\frac{1}{2}$	R	9	L	96	O.	$3\frac{1}{2}$	L	9	L	48	O.	1	L	9
R	20	I.	$0\frac{1}{2}$	L	9	L	96	O.	$0\frac{1}{2}$	L	9	L	48	O.	$0\frac{1}{4}$	R	9
R	20	I.	4	L	9	L	96	O.	2	L	9	L	4	I.	6	R	9
R	$64\frac{3}{4}$	O.	$7\frac{3}{4}$	L	9	L	96	O.	2	L	9	L	4	I.	$5\frac{1}{2}$	R	9
L	$64\frac{1}{4}$	O.	9	L	9	L	48	O.	$1\frac{1}{2}$	L	9	L	8	I.	6	L	9
L	96	I.	1	L	9	L	48	O.	0	L	9	L	8	I.	8	L	9
L	96	O.	7	L	9	L	48	O.	$1\frac{1}{4}$	L	9	L	12	I.	8	L	9
L	96	O.	8	L	9	L	39	O.	$3\frac{1}{2}$	L	9	L	12	I.	0	L	9
L	96	I.	3	L	9	L	39	O.	2	L	9	L	16	I.	$7\frac{1}{2}$	L	9
L	96	I.	$3\frac{1}{2}$	L	9	L	40	O.	2	L	9	L	16	I.	8	L	9
R	12	O.	$3\frac{1}{2}$	L	6	L	40	O.	0	L	9	L	20	I.	5	R	9
R	12	I.	$3\frac{3}{4}$	L	9	L	40	O.	2	L	9	L	20	O.	2	R	$\frac{1}{4}$
L	12	O.	$6\frac{3}{4}$	L	2	L	96	O.	$6\frac{1}{2}$	L	9	L	24	O.	$2\frac{1}{4}$	R	$\frac{1}{4}$
L	12	I.	$0\frac{3}{4}$	R	4	L	96	I.	$0\frac{1}{2}$	L	9	L	28	O.	1	R	$\frac{1}{4}$
L	12	I.	$2\frac{1}{2}$	R	6	L	96	I.	$0\frac{1}{2}$	L	9	L	32	O.	$1\frac{1}{2}$	R	$\frac{1}{4}$
L	12	I.	$4\frac{1}{2}$	R	8	L	96	O.	$7\frac{1}{2}$	L	9	L	36	O.	$1\frac{1}{4}$	R	$\frac{1}{4}$
L	48	O.	5	L	9	L	96	I.	0	L	9	L	40	O.	1	R	$\frac{1}{4}$
L	56	O.	8	L	9	L	40	O.	8	L	9	L	44	O.	$0\frac{1}{2}$	R	$\frac{1}{4}$
L	96	I.	$2\frac{1}{2}$	L	9	L	40	O.	5	L	9	L	48	O.	$0\frac{1}{2}$	R	$\frac{1}{4}$
L	96	I.	5	L	9	L	48	O.	1	L	9	L	52	O.	$0\frac{1}{4}$	R	$\frac{1}{4}$
L	40	O.	5	L	9	L	48	O.	$0\frac{1}{4}$	L	9	L	56	O.	$0\frac{1}{8}$	R	$\frac{1}{4}$
R	46	O.	9	L	9	L	12	I.	7	L	9	L	60	O.	0	R	$\frac{1}{4}$
B	8	O.	2	R	9	L	12	O.	$2\frac{1}{4}$	L	9	L	64	O.	0	R	$\frac{1}{4}$
R	96	O.	6	R	9	L	12	O.	$6\frac{1}{2}$	L	9	L	96	O.	0	R	$\frac{1}{4}$
L	96	O.	9	L	9	L	12	I.	0	L	9	L	96	O.	0	L	$\frac{1}{4}$

Whence

Whence you may be pleased to observe:

First, that the recoil of the Piece being hindred only at R or L, what soever be the charge of the Powder, the Bullet still misses the Mark, placed at the Mouth of the Gun, on the same side that the recoil is made.

Secondly, That about twelve grains of Powder shoots widest from the Mark at all distances above-mentioned, on the same side that the recoil is made.

Thirdly, That above Forty-eight Grains of Powder shoots wide from the mark, placed at nine foot from the Muzzle of the Piece, on the contrary side to that on which the recoil is made.

The Cause of the first I cannot doubt to be the recoil of the Piece (from the Force of the Powder) before the Bullet be parted from it.

The second is, as I conceive, because with less than twelve Grains the Piece ceaseth to recoil before the Bullet be parted from it. And with more than twelve Grains the Bullet is parted from the Piece before it hath recoiled so far: A greater power not moving a greater weight swifter (horizontally) in the same proportion that it doth the lesser.

And for the third I have this to offer, viz. Because the Mouth of the Gun is moving sideways whilst the Bullet is going out; therefore the Mouth of the Piece must be contiguous (at least) unto the Bullet on the contrary side to that on which the Piece recoils, some time after the separation made on the other side, and therefore the last impulse of the Bullet from the force of the Powder is on that side the Piece recoils; wherefore the Bullet must necessarily cross the Axis of the Piece, and that with a greater or lesser Angle, according to the force of the Powder; and when this Angle therefore is greater than the Angle of recoil,
I then

then must the Axis of that Cylinder in which the Bullet moves cross the Axis of the Mark, beyond which interjection the mark being placed, the Bullet must be carried necessarily wide of the Mark on the contrary side to the recoil of the Piece.

Fig. 2. Let $a = d$.

and $d c = r$.

and therefore $ab = r -$

$\sqrt{r^2 a^2}$

Therefore $a b . a d :: r -$

$\sqrt{r^2 a^2} a :: 1 . x$ (x

being any given quantity.)

Wherefore $a = x r - x \sqrt{r^2 a^2} :$

$r^2 a^2 :$
and $x \sqrt{r^2 a^2} := x r$
--a.

Therefore $x^2 r^2 x^2 a^2 x r^2 -$
 $2 x r a + a.$

Therefore $2 x r a = x^2$
 $a^2 + a^2 :$

Therefore $\frac{a x r}{x^2 + 1} = a$

Quod &c.

$f e k = f l p = p h m$
= the Angle of Recoil
 $p h n$ the Angle of Reflexion made at the parting of the Bullet from the Piece. When $p h n > p h m$ ($m h$ being always parallel to $f g$) then must $h n$ intersect $f g$ if continued.

Some other Experiments I have also made with another Piece (about the same length, but of a bore near two tenths of an Inch less) and ordered in the same manner; and do find, that with a small charge the Bullet is shot (thence too) wide of the mark on the same side on which the Recoil is made, and with a full Charge wide the contrary side.

I caused besides two Pistol-barrels of about five inches long to be placed upon Carriages with four Wheels, and loaded with Lead, that they might not overturn when discharged, and both of equal weight, and an Iron Cylinder of the length of both their bores, and of the same diameter with a piece of Lead of weight equal to it. So that the piece of Lead affixed to either of these Guns (which of them I should please to charge) might equally poise the other with the Iron Cylinder. And thus indifferently charging either with eight grains more or less of Powder, and putting the Iron Cylinder home into both, the piece of Lead being affixed to that which held the Powder, and then both so set upon the floor, and the Powder fired, I could not thereby discover, that the charged Piece, or the other, either of them, did certainly recoil more or less than the other, they rather seemed still to be equal.

These few Experiments I have made since, the Barrel being first cut at the muzzle parallel to a vertical Plane passing the line CD.

B	48	o.	8	L	R	48	i.	2	L
B	48	o.	9	L	L	48	o.	2	L
B	16	o.	1	R	L	48	o.	3	L
B	8	o.	2	R					
B	8	o.	o	N					

Besides

Besides these, there is another that I shall mention, and that is, the Experiment it self, or the Double-Bottom'd Ship, invented by Sir *William Petty*: of this I will venture to add a few Words, and I think I may do it without transgressing that Rule I had fix'd to my self, of not enlarging on the praise of particular Names, or Designs. For since the *Experiment* it self is lost, I hope I may securely speak of its Advantages: seeing Men are wont out of common humanity to allow the commendations of dead Men, I trust I may commend a *wreck'd Ship*, without any fear of the envy that may thence arise to the *Author*. In brief therefore I will say this of it, that it was the most considerable *Experiment* that has been made in this *Age* of *Experiments*: if either we regard the great charge of the work, or the wonderful change it was likely to make in *Navigation*, or the great success, to which this first *Attempt* was arriv'd. Tho' it was at first confronted with the doubts, and objections of most *Seamen* of our *Nation*, yet it soon confuted them by *Experience*. It appear'd very much to excel all other forms of *Ships*, in sailing, in carriage, in security, and many other such benefits. Its first *Voyage* it perform'd with admirable *swiftness*. And tho' it miscarried after its return, yet it was destroy'd by a common fate, and by such a dreadful *tempest*, as overwhelm'd a great *Fleet* the same Night: so that the ancient Fabricks of *Ships* have no reason to triumph over that new *Model*, when of threescore and ten Sail that were in the same *Storm*, there was not one escap'd to bring the News.

In a word, though this *Invention* succeeded not, while it was only supported by *private Purposes*; it will undoubtedly produce great effects, if ever it shall

be retriev'd upon the *publick Stock* of a *Nation*: which will be able to sustain the first hazards and losses that must be allowed to happen in the beginnings of all extraordinary *Trials*.

To their *Experiments* I will subjoin their *Observations*, which differ but in name from the other, the same fidelity and truth being regarded in collecting them both. §. XXXIV.
Their Observations.

Observations of the *fix'd Stars* for the perfecting of *Astronomy*, by the help of *Telescopes*: of the *Comets* in 1665 and 1666, which were made both in *London*, and elsewhere; and particularly of the first *Comet*, for above a month after it disappear'd to the naked eye, and became Stationary, and Retrograde.

Observations about *Saturn*, of the proportion, and position of its *Ring*, of the motion and orbit of its *Lunale*, of the shadow of the *Ring* on the *Body*, and of the *Body* on the *Ring*; and of its *Phases*, &c. of *Jupiter's Belts*, and of its spots, and verticity about its *Axis*, of its eclipsing its *Satellites*, and being eclips'd by them; of the Orbs, Inclinations, Motions, &c. of the *Satellites*, together with *Tables*, and *Ephemerides* of their motions.

Observations of the Spots about the Body of *Mars*, and of its whirling motion about its Center: of several Eclipses of the *Sun* and *Moon*, and some of them as were not taken notice of by *Astronomers*, or *Tables* commonly used: of the Spots in the *Moon*, and of the several appearances in the *Phases* of it: of the *Moon* at the same time, by *Correspondents* in several parts of the World, towards the finding her Parallax, and Distance.

Observations of the elliptical and waved Figures of the *Planetary Bodies*, near the *Horizon* from the Refraction of the *Hemisphere*: of the effects of *Lightning*: of the various pressure of the *Atmosphere*, by a *Wheel-barometer* for several Years, and of its usefulness for predicting the changes of Weather.

Observations on frozen *Beer*: on the Figures of *Snow*, frozen *Water*, *Urine* congeal'd: on the suspension of *Mercury* at a great height: on *Mines* and *Minerals*: on the Concretions of *Wood*, *Plants*, *Shells*, and several *Animals* Substances: on the effects of *Earthquakes*, *Fiery Eruptions*, and *Inundations*: on *Lakes*, *Mountains*, *Damps*, *subterraneous Fires*: on *Tides*, *Currents*, and the *Depth of the Sea*.

Observations of the liming of *Ground*, for improvement of the Bodies of *Sheep*, but spoiling their *Wool*: of several ways for preventing smutty *Corn*: of the importance of changing *Seed-Corn*: of the alteration of the *Horns* of *Sheep*, and other *Cattle*, by the change of *Pasture*: of the *Pores* and *Valves* in *Wood*: the *Anatomy* of *Trees*: of the sensitive, and humble *Plant*.

Observations on the *Bills of Mortality*: on the *Leaves of Sage*: on small living *Flies* in the Powder of *Cantharides*: of *Insects* bred in *Dew*: of *Virginian Silk-Bottoms*: of the *Parts*, and *Anatomy* of *Fishes*: of the *Teeth* of *Lupus Marinus*, that they are the same thing with the *Toad-stones* set in *Rings*: of the *Respiration* of *Fishes*: of *Bernacles*: of the calcin'd Powder of *Toads*: of an outlandish *Deer-Skin*, and *Hair*: of the *Parts* of *Vipers*: of *Stones* taken out of the *Heart* of a *Man*: of young *Vipers*: that they do not eat holes through their old ones *Bellies*, as is commonly affirm'd.

For *Examples* of this Head, I will, only refer my Reader to those which Mr. *Graunt* has published on the *Bills of Mortality*; wherein the *Author* has shewn, that the meanest and most trivial Matters may be so cultivated, as to bear excellent Fruit, when they come under the Management of an accurate and prudent *Observer*: For, from those *Papers*, which went about so many Years, through every Tradesman's Hands, without any manner of Profit, except only to the Clerks that collected them, he has deduc'd many true Conclusions, concerning the gravest and most weighty Parts of *Civil Government*, and *humane Nature*.

As I am now passing away from their *Experiments*, §. XXXV. and *Observations*, which have been their proper and principal Work; there comes before me an *Objection*, which is the more to be regarded, because it is rais'd by the *Experiments* themselves. For it is their common Complaint, that there is a great *nicety*, and *contingency*, in the making of many *Experiments*: that their Success is very often various and inconstant, not only in the Hands of *different*, but even of the same *Triers*. From hence they suggest their Fears, that this continuance of *Experimenters*, of which we talk so much, will not prove so advantageous, though they shall be all equally cautious in *observing*, and faithful in recording their *Discoveries*: because it is probable, that the *Trials* of future Ages will not agree with those of the present, but frequently thwart and contradict them.

The *Objection* is strong and material; and I am so far from diminishing the weight of it, that I am rather willing to add more to it. I confess many *Experiments* are obnoxious to failing; either by reason of

some *circumstances*, which are scarce discernable, 'till the work be over: or from the diversity of *Materials*, whereof some may be *genuine*, some *sophisticated*, some *simple*, some *mix'd*, some *fresh*, some may have lost their *virtue*. And this is chiefly remarkable, in *Chymical Operations*, wherein if the dissolvents be ill prepar'd, if the *Spirits* be too much, or too little purify'd, if there be the least alteration, in the degrees of *Fire*, the quantity of *Matter*, or by the negligence of those that attend it, the whole course will be overthrown, or chang'd from its first purpose.

But what is now to be concluded from hence? Shall this *Instability*, and *Casualty* of *Experiments*, deter us from labouring in them at all? or should it not rather excite us to be more curious and watchful in their *Process*? It is to be allow'd, that such *undertakings* are wonderfully hazardous and difficult; why else does the *Royal Society* endeavour to preserve them from degenerating, by so many *forewarnings*, and *Rules*, and a *Method* so severe? It is granted, that their *event* is often uncertain, and not answerable to our expectations. But that only ought to admonish us, of the indispensable necessity of a jealous, and exact *Inquiry*. If the uncertainty proceeded from a constant irregularity of *Nature*, we had reason then to despair; but seeing it for the most part arises only from some defect or change in our progress, we should thence learn, first to correct our own miscarriages, before we cease to hope for the *success*.

Let then the *Experiment* be often renew'd. If the same kinds and proportions of *Ingredients* be us'd, and the same circumstances be punctually observ'd, the *effect* without all question will be the same. If some little variation of any of these, has made any alteration

tion, a judicious and well practis'd *Trier* will soon be able to discern the *cause* of it; and to rectify it, upon the next repetition. If the difference of *time*, or *place*, or *matter*, or *Instruments*, will not suffer the product to be just the same in all points; yet something else will result, that may prove perhaps as beneficial. If we cannot always arrive at the main end of our *Labours*, some less unsought *Curiosities* will arise. If we cannot obtain that which shall be useful for practice, there may something appear that may instruct.

It is stranger that we are not able to inculcate into the minds of many men, the necessity of that *distinction* of my Lord *Bacon's*, that there ought to be *Experiments* of *Light*, as well as of *Fruit*. It is their usual word, *What solid good will come from thence?* They are indeed to be commended for being so severe *Exacters* of *goodness*. And it were to be wish'd, that they would not only exercise this vigour, about *Experiments*, but on their own *lives*, and *actions*: that they would still question with themselves, in all that they do, what *solid good will come from thence?* But they are to know, that in so large, and so various an *Art* as this of *Experiments*, there are many degrees of usefulness: some may serve for real, and plain *benefit*, without much *delight*: some for *teaching* without apparent *profit*: some for *light* now, and for *use* hereafter; some only for *ornament*, and *curiosity*. If they will persist in condemning all *Experiments*, except those which bring with them immediate *gain*, and a present *harvest*; they may as well cavil at the Providence of God, that he has not made all the seasons of the year, to be times of *mowing*, *reaping*, and *vintage*.

§. XXXVI. Of the variety, and excellence of the *Instruments*, with which this Age abounds, for their help in *Philosophical* matters, I have already discoursed in the former Part. I will now go on to mention those new ones, which they themselves, or some of their Members, have either *invented*, or *advanc'd*, for the ease, strength, and direction of their *Senses*, in the motions of *Nature*, and *Art*: of this kind are these that follow.

An *Instrument*, for finding a Second of Time by the Sun: another for finding the Celestial Refractions.

Three several *Quadrants* made after three new contrivances, which though they are not above eighteen Inches in Diameter, and so are manageable in any Window, or Turret, are yet far more exact than the best, that have been hitherto us'd, for *Astronomical Observations*, or taking Angles at Land.

A new *Instrument*, for taking Angles by reflection; by which means the Eye at the same time sees the two Objects, both as touching in the same point, though distant almost to a Semicircle: which is of great use for making exact *Observations* at Sea.

A new kind of *Back-staff*, for taking the Sun's Altitude by the Shadow, and Horizon: which is so contriv'd, that though the Shadow be at three foot distance, or as much more as is desir'd, yet there shall not be the least *Penumbra*: and the Shadow may be easily distinguish'd to the fourth part of a minute.

A *Hoop* of all the fix'd Stars in the *Zodiac*, for the speedy finding the Position of the *Ecliptic*, and for knowing the Extent of the *Constellations*.

A *Copernican Sphere*, representing the whirling Motion of the Sun, and the Motion of the several Planets.

A great many new ways of making *Instruments*, for keeping time very exactly, both with *Pendulums*, and without them ; whereby the intervals of time may be measur'd both on the *Land*, and *Sea*.

A universal *Standard*, or measure of *Magnitudes*, by the help of a *Pendulum*, never before attempted.

A new kind of *Pendulum Clock*, wherein the *Pendulum* moves circularly, going with the most simple, and natural motion, moving very equally, and making no kind of noise.

A *Pendulum Clock*, shewing the æquation of Time.

Three new ways of *Pendulums* for *Clocks*, and several ways of applying the motion of the Watch-work to them.

Several new kinds of *Pendulum Watches* for the Pocket, wherein the motion is regulated, by Springs, or Weights, or Loadstones, or Flies moving very exactly regular.

Several sorts of *Instruments* for compressing, and rarefying the Air: A *Wheel-Barometer*, and other *Instruments* for finding the pressure of the Air, and serving to predict the changes of the Weather.

A new kind of *Scales*, for examining the gravity of Bodies in all places: to see whether the attraction of the *Earth*, be not greater in some parts of the *Earth*, than in others ; and whether it do not decrease, at farther distances from the surface of the *Earth*, either upwards into the *Air*, or downwards under the *Earth*.

A very exact pair of *Scales*, for trying a great number of *Magnetical Experiments*.

Several

Several very accurate *Beams*, for trying many *Statistical Experiments*, and for finding the most exact gravity of several kinds of Bodies.

A great number of *Magnetical Instruments*, for making *Experiments* about *Loadstones*.

Several new kinds of *Levels*, for finding the true Horizon, where, by one of not above a foot length, the Horizontal line may be found, without the error of many seconds.

A new kind of *Augar*, for boring the ground, and fetching up whatever it meets with in the right order.

A new *Instrument*, for fetching up any Substance from the bottom of the Sea, whether Sand, Shells, Clay, Stones, Minerals, Metals.

A new *Bucket*, for examining and fetching up whatever Water is to be found at the bottom of the Sea, or at any depth, and for bringing it up without *mixing* with the other Water of the Sea, through which it passes.

Two new ways of sounding the depth of the Sea without a Line, for examining the greatest depth of the Ocean, in those parts of it, that are most remote from the Land.

Several *Instruments* for finding the velocity of swimming Bodies of several Figures, and mov'd with divers strengths, and for trying what *Figures* are least apt to be overturn'd, in order to the making a true *Theory*, of the *Forms* of *Ships*, and *Boats* for all uses.

An *Instrument* of great height, with Glass windows on the sides, to be fill'd with Water, for examining the velocity of Bodies of several Substances, Figures and Magnitudes, by their descent.

An *Instrument* for measuring, and dividing the time of their Descent, to the accurateness of two, or three thirds of time, serving also for examining the swiftness of Bodies descending through the Air, and of Bodies shot by a Gun, or Bow.

A *Bell* for diving under water to a great depth, wherein a man has continued at a considerable depth under water, for half an hour, without the least inconvenience.

Another *Instrument* for a *Diver*, wherein he may continue long under water, and may walk to and fro, and make use of his strength and limbs, almost as freely as in the Air.

A new sort of *Spectacles*, whereby a *Diver* may see any thing distinctly under Water.

A new way of conveying the *Air* under Water, to any Depth, for the use of *Divers*.

An *Instrument* for measuring the swiftness, and strength of the *Wind*.

An *Instrument* for raising a continual stream of *Water*, by turning round a moveable valve, within the hollow of a close *Cylindrical* Barrel.

Several kinds of *Thermometers* for discovering the heat, and cold of the *Air*, or any other Liquors: a *Thermometer* for examining all the degrees of heat in Flames, and Fires, made of several Substances; as also the degrees of heat requisite to melt Solder, Lead, Tin, Silver, Brass, Iron, Copper, Gold.

A *Standard* for Cold several ways.

An *Instrument* for planting of Corn.

Four several sorts of *Hygrosopes* made with several Substances, for discovering the drowth, and moisture of the Air.

Several kinds of ways to examine the goodness, and badness of *Waters*.

Several *Engines* for finding, and determining the force of *Gun-powder*, by *Weights*, *Springs*, *Sliding*, &c.

An *Instrument* for receiving, and preserving the force of *Gun-powder*, so as to make it applicable, for the performing of any motion desir'd.

Several *Instruments* for examining the recoiling, true carriage, and divers other properties of *Guns*.

Several kinds of *Otocousticons*, or *Instruments*, to improve the sense of hearing.

Several *Models* of *Chariots*, and other *Instruments*, for *Progressive Motion*.

A *Chariot-way-wiser*, measuring exactly the length of the way of the *Chariot*, or *Coach*, to which it is apply'd.

An *Instrument* for making *Screws* with great dispatch.

A way of preserving the most exact impression of a *Seal*, *Medal*, *Sculpture*; and that in a Metal harder than *Silver*.

An *Instrument* for grinding *Optick-glasses*: a double *Telescope*: several excellent *Telescopes* of divers lengths of six, twelve, twenty-eight, thirty-six, sixty foot long, with a convenient *Apparatus* for the managing of them: and several contrivances in them for measuring the *Diameters*, and parts of the *Planets*, and for finding the true position, and distance of the small fix'd *Stars*, and *Satellites*.

Towards the exactness of all manner of these *Optick-glasses*, the *English* have got a great advantage of late years, by the *Art* of making *Glass*, finer, and more serviceable for *Microscopes*, and *Telescopes*, than that of *Venice*. This Invention was brought into our Country,

try, and practis'd here, by the care, and expence of the Duke of *Buckingham*; whom the Author of these Papers ought to mention with all honour; both for his Skill and Zeal in advancing such *Experimental Studies* of which I am writing: and also because it has been by the favour of so great a *Patron*, that I have enjoy'd the leisure, and convenience of composing this *History*.

As soon as they were reduc'd into a *Fix'd Assembly*, §XXXVII.
 one of the Principal Intentions they propos'd to accomplish, was a General Collection of all the Effects of *Arts*, and the Common, or Monstrous *Works of Nature*. This they at first began by the casual *Presents*, which either *Strangers*, or any of their own *Members* bestow'd upon them. And in short time it has increas'd so fast, by a contribution from all Parts, and chiefly by the bounty of Mr. *Colwal*, that they have already drawn together into one Room, the greatest part of all the several kinds of things, that are scatter'd throughout the *Universe*. The Keeping, and Ranging of these into order, is committed to Mr. *Hook*, who had also the honour of being made the first *Curator* of the *Royal Society* by election. This *Repository* he has begun to reduce under its several heads, according to the exact Method of the Ranks of all the *Species* of *Nature*, which has been compos'd by Dr. *Wilkins*, and will shortly be publish'd in his *Universal Language*: A Work wherein this excellent Man has undertaken a Design, that very well fits the temper of his own Mind; for it well became him to teach a *Communion* of Speech amongst all *Philosophers*; whose chief study it has always been, to promote a general agreement, and

Their Repository and Library.

correspondence amongst all virtuous and wise Men.

This *Book* had sooner seen the light, if part of it had not perish'd in the *Fire*. Of its use and accurate composition there is no man can doubt, that has ever heard the name of the *Author*: of whom, if I had not at first restrain'd my self from particular commendations, I might have said very much in his praise, which deserves to be known to all the World, and to be the first *Experiment* of his own *Universal Language*.

*Their Li-
brary.*

Having well succeeded in this their purpose of *collecting* divers patterns of all *Natural*, and *Artificial* things: they have also (amongst others) appointed a *Committee*, whose chief employment shall be to read over whatever *Books* have been written on such subjects. By this means they hope speedily to observe, and digest into *Manuscript volumes*, all that has been hitherto try'd, or propounded in such studies. This is the only help that an *Experimenter* can receive from *Books*: which he may still use, as his *Guides*, though not as his *Masters*. For this end they have begun a *Library*, consisting only of such *Authors*, as may be serviceable to their *Design*. To this there has been lately made a great Addition, by the Munificent Gift of Mr. *Henry Howard* of *Norfolk*, who has bestow'd on the *Society* the whole *Arundelian Library*, containing several hundreds of choice *Manuscripts*, besides some thousands of other *Books* of all kinds. And because many of them belong'd to other *Professions*, this Noble Benefactor has given them with a free permission of changing them for others, that shall be more proper for their *Work*: Whereby they will shortly be able to shew a compleat *Collection* of all that has been

pub-

publish'd in the Ancient, or Modern Tongues, which either regards the productions of *Nature*, or the effects of all *Manual Arts*.

Nor is this the only bounty which this Illustrious *Person* has conferr'd on the *Royal Society*; since by the firing of *London*, the first place of their meeting has been restored to its original use, and made an *Exchange*, he has afforded them a retreat in his own house, where they assemble at this present: By which favour he has added a new honour to the ancient *Nobility* of his *Race*: one of his *Ancestors* had before adorn'd that place with many of the best Monuments of *Antiquity*: and now by entertaining these new discoveries under his Roof, his *Family* deserves the double Praise of having cherish'd both the old, and new *Learning*; so that now methinks in *Arundel-house*, there is a perfect representation, what the real *Philosophy* ought to be: As there we behold new *Inventions* to flourish amongst the *Marbles*, and *Images* of the *Dead*: so the present *Arts*, that are now rising, should not aim at the destruction of those that are past, but be content to thrive in their company.

It will not I hope be expected, that I should present my *Reader* an *Index* of all the several *Writings*, which have at any time been publish'd by the *Members* of the *Royal Society*. I shall omit those, which either were printed before the beginning of this *Institution*, or which treat of matters, that have no relation to their *Design*. Only I will say in general, that there is scarce any *Art*, or *Argument*, which has ever been the subject of humane *Wit*, of which I might not produce Instances, that some *Fellows* of this *Society* have given good proofs of their labours in it: of those *Discourses*, which

Sect.
XXXVIII.
Their Discourses and Theories.

which have been since compos'd by some of their *Body*, or read before their weekly *Assemblies*, and directly concern the advancement of their *Work*, these are the principal.

Several *Hypotheses*, explaining the divers *Phases* and *Motions*, and other *Phænomena* of the *Comets*.

Several *Hypotheses* of *Saturn*, and its *Satellites*.

An *Hypothesis* of the cause of the *Rugosity* of the *Moon's* surface.

An *Hypothesis* of the motion of the *Moon*, and of the *Sea* depending upon it.

An *Hypothesis* of the motion of the *Planets*, and of Circular *Motion* in general.

Several *Hypotheses* for the *Æquation* of Time.

A *Discourse* about the possibility of the Retardation of *Cælestial Motions*, and of their going slower, and slower, the longer they last.

A *Discourse* of making the several *Vibrations* of a *Pendulum* equal, by making the weight of it move in a *Cycloid* instead of a *Circle*.

Several *Discourses*, and *Hypotheses* about the length of a *Pendulum*, for moving once in a second of Time.

A *Discourse* of the most convenient length of a *Pendulum*, for making a Standard for a universal Measure.

Several *Astronomical Discourses* of Mr. *Hortex* retriev'd, and digested for the Press.

Uleg Beg translated, about the places of the fix'd Stars, and several other *Astronomical Observations*.

A *Discourse* about the possibility of the change of the attractive power of the *Earth*, and consequently of the variation of the vibrative motion of *Pendulums*.

A *Discourse* about short inclining *Pendulums*, and of other *Pendulums* counterpois'd above the Center of Motion,

Motion, and of others lying *Horizontal* in the manner of a Beam.

An *Hypothesis* about *Fire*, and *Flame*.

An *Hypothesis*, and discourse of the gravity, pressure, and spring of the *Air*.

A *Discourse* of an *Air Register*.

Several *Discourses* Mathematical, and Philosophical, upon the *Experiment* of raising great weights by the *Breath*.

A *Discourse* and Demonstration against a propos'd Method of doubling the *Cube*, and of finding two mean *Proportionals*.

Several *Discourses* about *Thermometers*, *Hygrosopes*, *Baroscopes*, and other *Weather-wisers*.

An *Hypothesis* and *Discourse* of the *Inflexion* and inflective veins of the *Air*, and of the fitness, and unfitness of the *Air* for *Celestial Observations*.

An *Hypothesis* of the Form, and Spring of the *Air*.

A *Discourse* of the different parts of the same *Water*, and of the difference of *Waters*.

A *Discourse* and *Hypothesis* of *Filtration*, and of the Congruity, and Incongruity of *Bodies*.

A *Discourse* of the possible height of the *Air*, and of its proportionable rarefaction upwards.

An *Hypothetical Discourse* about the suspension of the *Clouds*, and their pressure.

An *Hypothesis*, and *Discourse* of *Earthquakes*.

A *Discourse* of *Petrifications*, and an *Hypothesis* for explaining the several varieties of such *Bodies*.

Several *Discourses* about the *Loadstone*, and an *Hypothesis* for salving its appearances.

A *Discourse* about the Pores of *Stones*.

A *Discourse* about *Eggs*.

A *Discourse* concerning the *Glass-drops*.

A *Discourse* and *Hypothesis* of annealing, and tempering Steel.

Discourses about Cyder, and Coffee.

A *Discourse* of the original of Forms.

An *Hypothesis* of Light.

A *Discourse* and *Hypothesis* of the Nature and Properties of Colours.

A *Discourse* about improving Wood for Dying, and for fixing Colours.

A *Discourse* about the improvement of Musick

A *Discourse* of the differing Heat of Summer, and Winter.

A *Discourse*, and *Hypothesis* about Fluidity.

Discourses upon several *Mercurial Experiments*.

Discourses of *Hydrostaticks*.

Discourses about the force of falling Bodies.

A *Treatise* of the motion of the Muscles.

A *Discourse* of the Usefulness of Experimental Philosophy.

A *Treatise* of the vanity of Dogmatizing.

The Sceptical Chymist.

Essays about Salt-peter.

The *Parallel* of the Ancient, and Modern Architecture.

Microscopical Observations.

Micrographia, or a *Discourse* of things discover'd by a *Microscope*.

Three *Books* of *Fevers*, of the Brain, and of the Scurvy, which I will alledge as the great Instances of this head: Wherein the famous *Author* has with accurate Diligence made prodigious improvements in all the parts of Physick, and shewn that the largeness of his *Knowledge* in it, is equal to the happy success of his *practice*.

In this Collection of their *Discourses*, and *Treatises*, my Reader beholding so many to pass under the name of *Hypotheses*, may perhaps imagine that this consists not so well with their Method, and with the main purpose of their *Studies*, which I have often repeated to be chiefly bent upon the *Operative*, rather than the *Theoretical Philosophy*. But I hope he will be satisfied, if he shall remember, that I have already remov'd this doubt, by affirming that whatever *Principles*, and *Speculations* they now raise from things, they do not rely upon them as the absolute end, but only use them as a means of farther *Knowledge*. This way the most speculative *Notions*, and *Theorems* that can be drawn from matter, may conduce to much profit. The light of *Science*, and *Doctrines* of causes, may serve exceeding well to promote our *Experimenting*; but they would rather obscure, than illuminate the Mind, if we should only make them the perpetual Objects of our *Contemplation*: as we see the light of the Sun, is most beneficial to direct our footsteps in walking, and our hands in working, which would certainly make us blind, if we should only continue fix'd, and gazing on its Beams.

The *Histories* they have gather'd, are either of *Nature*, *Arts*, or *Works*. These they have begun to collect by the plainest Method, and from the plainest Information. They have fetch'd their Intelligence from the constant and unerring use of *experienc'd Men* of the most unaffected, and most unartificial kinds of life. They have already perform'd much in this way, and more they can promise the world to accomplish in a very short space of time.

§.XXXIX.
The Histories they have collected.

There are already brought in to them the *History* of *Comets* in general, and especially of the two last: The History of *English Mines*, and *Oars*: And particularly two several *Histories* of *Tinneries* and *Tin-working*.

The *Histories* of *Iron-making*: of *Lignum Fossile*: of *Saffron*: of *Alkermes*: of *Verdigreace*: of *whiting of Wax*: of *Cold*: of *Colours*: of *Fluidity*, and *Firmness*.

The *Histories* of *Refining*: of making *Copperas*: of making *Allum*: of *Salt-peter*: of making *Latten*: of *Lead*: of making *Salt* out of *Sea-water*: of *refining Gold*: of making *Pot-ashes*: of making *Cerule*: of making *Brass*: of *Painting*, and *Limning*: of *Calcography*: of *Enamelling*: of *Varnishing*: of *Dying*.

The *Histories* of making *Cloth*: of *Worsted-Combers*: of *Fullers*: of *Tanners*, and *Leather-making*: of *Glovers*, and *Leather-dressing*: of *Parchment*, and *Vellum-making*, and the way of making *transparent Parchment*: of *Paper-making*: of *Hatters*: of making *Marble Paper*: of the *Rowling-Press*.

The *Histories* of making *Bread*: of *Malt*: of *brewing Beer* and *Ale* in several places: of *Whale-fishing*: of the *Weather* for several years: *Wind-mills*, and other *Mills* in *Holland*: of *Masonry*: of *Pitch* and *Tar*: of *Maiz*: of *Vintners*: of *Shot*: of making *Gun-powder*: and of making some that is twenty times as strong as the common *Pistol-powder*.

The two last of these were communicated to the *Royal Society* by the favour of *Prince Rupert*; whom I take the boldness to mention here, for his excellent Knowledge, and use in all manner of *Mechanical Operations*. But his name will be recorded in all

the *Histories* of this Time, for greater works, for many glorious enterprises by Sea and Land, and for the Immortal Benefits whereby he has oblig'd the *English Nation*.

The Instances that I shall give of this their manner of collecting *Histories*, shall be, of *Works*; that of *Salt-peter*; of *Arts*, that of *Dying*; of *Nature*, that of *Oysters*: which last may perhaps seem a subject too mean to be particularly alledg'd: but to me it appears worthy to be produc'd. For tho' the *British Oysters* have been famous in the World, ever since this Island was discover'd, yet the skill how to order them aright, has been so little consider'd amongst our selves, that we see at this day, it is confin'd to some few narrow *Creeks* of one single County.



T H E

HISTORY

Of the Making of

SALT-PETER,

By Mr. HENSHAW.

‘ WHETHER the *Nitre* of the Antients be of
 ‘ the same species with the Salt which is com-
 ‘ monly known by the name of *Salt-peter*, is vari-
 ‘ ously disputed by very learned Authors amongst the
 ‘ modern Physicians: on the negative side are *Ma-*
 ‘ *thiolus* and *Bellonius*; the latter of which had the
 ‘ advantage, by the opportunity of his travels in *E-*
 ‘ *gypt*, to have often seen and handled them both, and
 ‘ is so positive as to pronounce, that in all *Christen-*
 ‘ *dom* there is not one grain of *Nitre* to be found, un-
 ‘ less it be brought from other parts, although at the
 ‘ time of his being in *Grand Caire* (which was about
 ‘ the year 1550) it was so common there (as he says)
 ‘ that ten pounds of it would not cost a *Moidin*.
 ‘ Among those that hold the affirmative, the most
 ‘ eminent are *Cardan* and *Longius*; and it should
 ‘ seem the general vote of learned Men hath been
 ‘ most favourable to that Opinion, by reason that in
 ‘ all Latin Relations and Prescriptions, the word *Ni-*
 ‘ *trum* or *Halinitrum* is most commonly used for
 ‘ *Salt-peter*.

' I have often enquired, amongst our *London*
 ' Drugsters, for *Egyptian Nitre*, and if I had been so
 ' fortunate as to have found any, I doubt not but I
 ' should have been able to have put an end to that
 ' Question by a Demonstration; that is, by turning
 ' the greatest part of it into *Salt-peter*. However,
 ' the Observations I have made in my own private
 ' Experiments, and in the practice of *Salt-peter-men*
 ' and Refiners of *Salt-peter*, seem to give me suffici-
 ' ent ground to suspect, that the confidence of those,
 ' who hold them to be several Salts, proceedeth
 ' chiefly from their being unacquainted with the
 ' various *Φαινόμενα* of *Salt-peter* in the marking and
 ' refining of it: and also their comparing double re-
 ' fined *Salt-peter* (of which Gunpowder is made)
 ' with that description of *Nitrum* and *Aphronitrum*
 ' in the tenth chapter of the one and thirtieth Book
 ' of *Pliny's Natural History* (the only tolerable ac-
 ' count of that Salt that hath been handed to us
 ' from Antiquity) where he tells us, That *Aphroni-*
 ' *trum* was *Colore pene purpureo*, and *Egyptian Nitre*
 ' *Fusum & Lapidosum*, adding afterward, *Sunt ibi*
 ' *Nitrariae in quibus rufum exit a colore terræ*, which
 ' is sufficient to have hinted to any one but mode-
 ' rately versed in the moderate way of ordering *Salt-*
 ' *peter*, that the Antients were not at all skilled in re-
 ' fining their *Nitre* from the Earth and common Salt
 ' that is usually mingled with it, nor from that foul
 ' yellow Oyl, which, it seems, did accompany their
 ' *Nitre*, as well as it doth our *Salt-peter*, in great
 ' abundance; for *Pliny* takes notice of it, when he
 ' mentions the removing the *Nitre* (after it is grain-
 ' ed) out of the *Nitrariae*, saying, *Hic quoque natura*
 ' *olei intervenit, ad scabiem animalium utilis*: And
 ' indeed

indeed this greasy Oyl (which the Workmen call *Mother of Salt-peter*, and perhaps is but the crude and unripe part of it) doth by nature so wonderfully adhere to every part else of the *Peter* (it may be ordained for the nutriment and augmentation of it) that the separation of it, is the sole cause of the great charge and labour that is required to the refining of *Peter*: otherwise the *Peter* will be yellow, or brown, or some other dark colour. And *Scaliger* in his 104. *Exercit. sect. 15.* saith, *Sublustris purpuræ quasi splendor quidem in salis-petræ terris sæpenumero est a nobis observatus*; and he that shall boil a Lixivium past through a *Salt-peter*-earth, up to a consistence, without filtering it through ashes, or giving the Salt leave to chrySTALLIZE, may perhaps find something not unlike the *Nitre* of the Antients.

To make this doubt yet clearer, it will require your patience to observe a few short remains out of the same *Pliny*, concerning the production of *Nitre*; saith he, *Exiguum Nitri fit apud Medos, candescitibus siccitate convallibus quod vocant Halmir-baga: minus etiam in Thracia juxta Philippos fordidum Terra quod appellant Agrium.*

This agrees very exactly with what I have been informed by a Refiner of *Salt-peter*, that near *Sophia*, *Santa-Cruz*, and several other places in *Babary*, he hath seen *Salt-peter* shoot out of the ground (as thick and white as a hoar frost) on many barren and desert Lands; only he adds, that this happens not till the beginning of the rains of *August*, or *September*; and that it is the falling of the fresh-water that causes the *Salt-peter* to shoot out into little ChrySTALS; and that the people of the Country

try

try do no more than take it off the ground as clean as they can, and sell it to Merchant-strangers. This is, says he, the *Barbary Peter*, which the Refiners buy commonly at twenty shillings *per Cent*.

Much after the same manner (by the relation of an *Indian Merchant*) is that great quantity of *Peter* produced, which of late years hath been brought into *England*, and other parts of *Christendom*, from about *Pegu* in *East-India*, saying that the Natives do refine it once, before they sell it to the Merchants: But being not so skilful, to discharge it from the common Salt, which attends *Peter*, our Workmen do refine it again, before it be fit for Gunpowder.

The next remark out of *Pliny*, is, *Aquæ vero Nitrosæ pluribus in locis reperiuntur, sed sine viribus Densandi* (he means the heat of the Sun in those places) *Optimum Copiosumque in Clytis Macedonia quod vocant Chalastricum candidum purumque proximum sali. Lacus est Nitrosus, exiliente è medio dulci fonticulo, ibi sit Nitrum circa Canis ortum, novenis diebus, totidemque cessat, & rursus innatat & deinde cessat, iis autem diebus quibus gignitur si fuere imbres salsius Nitrum faciunt, Aquilones deterius quia Validius commovent limum. In Egypto autem conficitur multò abundantius sed deterius, nam fuscum lapidosumque est, sit penè eodem modo quo Sal: nisi quod Salinis mare infundunt, Nilum autem Nitrariis.*

How such great plenty of *Nitre* should be found in the Waters above mention'd, will be no difficulty to conjecture, if we consider that Lakes are the receptacles of Land-floods, and that great Rains may easily bring it to the Lake in *Macedonia*, from the higher

‘ higher parts in the Country about it. And for the
 ‘ River *Nile*, there must needs be less scruple con-
 ‘ cerning it, if we call to mind that once in a year, it
 ‘ sweeps with an impetuous overflow the burnt and
 ‘ barren Desarts of *Africa* under the *Torrid Zone* ;
 ‘ where, by the relation of Travellers, those Sands
 ‘ are visibly full of *Nitre*, and those few Springs and
 ‘ Wells that are to be found there, are by that rea-
 ‘ son so bitter, that the *Moors* and their Camels are
 ‘ forced to make a hard shift with them in their long
 ‘ journeys.

‘ But when he comes to describe the *Aphronitrum*,
 ‘ he comes more home, both to the name and nature
 ‘ of our *Salt-peter*, in these words, *Proxima etas Me-*
 ‘ *dicorum tradidit, Aphronitrum in Asia Colligi in*
 ‘ *speluncis & molibus distillans, dein sole siccant.* And
 ‘ *Scaliger* speaking of *Salt-peter*, says, *Est quædam*
 ‘ *Nitri species inherens Rupibus, in quibus insolatur,*
 ‘ *ac propterea Salpetra dicitur.* And, I my self, for my
 ‘ own satisfaction in the point, have drawn very good
 ‘ *Rock-peter* out of those *Stirie*, which are usually
 ‘ found hanging like Icicles in arched Cellars and
 ‘ Vaults ; and have been told, that a Physician in *Shrop-*
 ‘ *shire* did perform great Cures by vertue of *Sal-pru-*
 ‘ *nelle*, which he made only of Flower of Brimstone
 ‘ and those *Stirie*.

‘ But to steer more directly upon our immediate
 ‘ subject *Salt-peter* ; tho’ it be likely, that the Air
 ‘ is every where full of a volatile kind of *Nitre*,
 ‘ which is frequently to be seen coagulated into fine
 ‘ white Salt, like Flower of Wheat (but by the ve-
 ‘ ry taste may be easily known to be *Peter*) sticking
 ‘ to the sides of Plaistered-walls, and in Brick-walls
 ‘ to the Mortar between the Bricks, (in dry wea-
 ‘ ther,

' ther, or where the wall is defended from the rain)
 ' for Lime doth strongly attract it; though Dew and
 ' Rain do convey much of it to the Earth, and the
 ' Clouds seem to be spread out before the face of the
 ' Sun, either to imbibe some part of his influence, or
 ' to have a Salt generated in them, for to advance the
 ' fertility of the Earth, and certainly they return not
 ' without a blessing; for I have more than once ex-
 ' tracted *Salt-peter* out of Rain and Dew, but from
 ' the latter more plentifully, and yet even there, is
 ' *Salt-peter* accompanied with a greasy purple Oil,
 ' in great plenty: Though (as I have found upon
 ' trial) that most standing waters, and even deep
 ' wells have some small quantity of *Salt-peter* in
 ' them; though the face of the Earth, if it were not
 ' impregnated with this Salt, could not produce Ve-
 ' getables; for Salt (as the Lord *Bacon* says) is the
 ' first Rudiment of Life; and *Nitre* is as it were the
 ' Life of Vegetables: Yet to be more sure of it, I made
 ' Experiment likewise there too, and found some little
 ' of it in fallows, and the earth which Moles cast up in
 ' the Spring: Though I say the Air and Water want
 ' it not, yet it is not there to be had in any proportion,
 ' answerable to the charge in getting it: And though
 ' the Earth must necessarily have great quantities there-
 ' of, generated or infused into it; yet in these tem-
 ' perate Countries of *Europe*, it is no sooner dilated by
 ' Rain-water, or the Moisture of the Earth, but it is
 ' immediately applied to the production or nutriment
 ' of some Plant, Insect, Stone, or Mineral; so that
 ' the Artist will find as little of it here to serve his turn,
 ' as in the other two Elements.

' The only place, therefore, where *Salt-peter* is to
 ' be found in these Northern Countries, is in Stables,

Pigeon-houses, Cellars, Barns, Ware-houses, or indeed any place which is covered from the Rain, which would dissolve it, and (as I have said) make it vegetate; as also from the Sun, which doth rarify it, and causeth it to be exhaled into the Air; (For the same reason Husbandmen also might make double or treble the profit they usually do of their Muck, if they will lay it up under a Hovel, or some covered place, until they carry it out upon their Land.) And I have been told by an experienced Workman, that no Earth yields *Peter* so plentifully, as that in Churches, were it not an impiety to disturb the Ashes of our Ancestors, in that sacred Depository.

Provided always, that the Earth be of good Mould, and the better the Mould is, the more *Peter* is produc'd; for in Clay, or sandy Earth, little or none is to be found: The freer ingress the Air hath into a place, is still of more advantage, so that the Sun be excluded; And let the Earth be never so good, if it be laid on a brick or boarded floor, it will not be so rich in *Peter*, as if it have free communication with the Exhalations of the lower parts of the Earth.

In any place thus qualified, you cannot miss of good quantities of *Peter*, if it have not been drawn out in some Years before; which a Workman will quickly find, after he hath digged the first spadeful of Earth, by laying a little of it on the end of his tongue, and if it taste bitter, he is sure of good store of mineral, (as they love to call it) that is, *Salt-peter*; if the Ground be good, it continues rich to six or eight foot deep, and sometimes, but not often, to ten.

After

‘ After the *Salt-peter* is extracted, if the Earth be laid wet in the same place again, it will be twenty Years e’er any considerable quantity grow there of it; but if the Earth be well dried, it will come in twelve or fourteen: and if they mingle with the dried Earth store of Pigeons-dung, and mellow Horse-dung, and then temper it with Urine (as was usual before we were supplied with *Peter* from *India*) it will be fit to dig again in five or six Years. He that shall cast Water upon a Ground fit to dig for *Peter*, will only sink the Mineral deeper into the Earth; but he that throws Soap-suds on it, will quite destroy the *Peter* (as the Workmen have a Tradition) and it very well deserves a further Enquiry.

‘ That *Salt-peter*, and the way of drawing it out of the Earth, now in use, was a modern Invention, is generally concluded by all Authors; but whether we owe it to chance, or the sagacity of some great Wit, is as unknown, as the time when it was first discovered.

‘ It seems to have many Years preceeded the Invention of Gun-powder, which by the *Germans* is ascribed to *Constantine Autlitzer*, or *Berthold Schwertz*, a Monk of *Friburgh*, and was, in all probability, not long discovered, when the Inventor (*Polydore Virgil* tells us) taught the use of Guns to the *Venetians*, at the Battel of *Fossa Claudia*, when they obtain’d that notable Victory over the *Genoueses*, Anno 1380. For there is mention made, both of *Salt-peter* and *Aqua-fortis*, in the Writings of *Geber*, a *Spanish Moor*, and an *Alchymist*; but at what time he lived, is unknown, though it be certain, some hundreds of Years before *Raimund Lully*, who

about the Year 1333; published some of his Books, wherein he treats of *Salt-peter* and *Aqua-fortis*. It is no ill conjecture of *Maierus*, that the foresaid Monk, being a skilfull Alchymist, had a design to draw a higher Spirit from *Peter* than the common *Aqua-fortis*; and that he might better open the Body of *Peter*, he ground it with Sulphur and Charcoal, by which Composure he soon became the Inventor of Gun-powder.

The Manner of making

SALT-PETER.

IN the first place you must be provided of eight or ten Tubs, so large, that they may be able to contain about ten Barrows full of Earth each of them. These Tubs must be all open at the top; but in the bottom of every one of them, you must make a hole near to that side you intend to place outmost, which hole you must fit very well with a Tap and Spigot on the outside downward. On the inside of the Tub, near the Tap-hole, you must carefully place a large wad of straw, and upon that a short piece of board, which is all to keep the earth from stopping up the Tap-hole. When you have placed your Tubs on their stands, at such a distance one from the other, that you may come with ease between them, then fill them up with such *Peter-earth* as you have chosen for your work, leaving only void about a span's breadth between the earth and the edge of the Tub; then lay on the top of the

the Earth in each Tub, as near as you can to the middle, a rundle of Wicker, like the bottom of a Basket, and about a foot in diameter, and by it stick into the Earth a good strong Cudgel, which must be thrust pretty near the bottom; the Wicker is to keep the Water, when it is poured on, from hollowing and disordering the Earth, and the Cudgel is to be stirred about, to give the Water ingress to the Earth upon occasion: Then pour on your Earth common cold Water, till it stand a hand's breadth over the Earth: When it has stood eight or ten hours, loosen the Spigots, and let the Water rather dribble, than run into half Tubs, which must be set under the Taps: This *Lixivium* the Workmen call their Raw-liquor; and note, that if it come not clear at the first drawing, you must pour it on again, and after some little time draw it off, till it come clear, and of the colour of Urine.

If you are curious to know how rich your Liquor is before boiling, you may take a Glass-phial, containing a Quart; fill it with the common Water you use, then weigh it exactly; next fill the same Glass with your Liquor, and find the difference of weight, which compared with the quantity of all your Liquors, will give you a very near guess, how much *Salt-peter* you are like to make by that boiling.

Then pour on again, on the same Earth, more common Water, that it may bring away what is remaining in the Earth of the former Liquor. This second Liquor is of no other use, but to be poured on new Earth, instead of common Water, because it contains some quantity of *Salt-peter* in it.

When

' When this is done, turn out the useleſs inſipid
 ' Earth out of the Tubs, which you muſt fill with
 ' new Earth, and continue this Operation, till you
 ' have in the ſame manner lixiviated all the Earth :
 ' Then fill your Copper with your Liquor, which
 ' Copper, for one of the Profeſſion, muſt be about
 ' two hundred weight, and ſet ſtrongly in a Furnace
 ' of brick-work; beſides, on one ſide of your Fur-
 ' nace you are to place a Tub full of your Liquor,
 ' which at a Tap below may dribble as faſt into the
 ' Copper, as the force of the Fire doth waſte your
 ' Liquor, which Invention is only to ſave charges in
 ' Fewel. When you have boyled it up to that height,
 ' that a little of it ſlirted off the ſinger on a live
 ' Charcoal, will flaſh like Gun-powder (which for
 ' the moſt part falls out to be about two Days and a
 ' Nights boiling) at what time, upon tryal, a hun-
 ' dred weight of the Liquor contains about five and
 ' thirty pound weight of *Peter*. But the Workmen
 ' ſeldom make uſe of any further indication, than by
 ' finding the Liquor hang like Oyl on the ſides of the
 ' braſen Scummer, when 'tis dipped into it, which is
 ' a ſign it is fit to be paſſed through the Aſhes, which
 ' is done in this manner.

' You muſt prepare two Tubs, fitted after the man-
 ' ner of the firſt, where you put your Earth, ſaving
 ' that at the bottom of theſe Tubs, you muſt lay
 ' Reeds or Straw a foot high; over them place looſe
 ' boards, pretty near one another; over them, a little
 ' more Straw (which is to keep the Aſhes from the
 ' top, and to give the Liquor room to drein the
 ' better from them :) Then fill up your Tubs with
 ' any ſort of Wood-aſhes to half a foot of the top;
 ' then pour on the foreſaid Liquor, as it comes ſcald-
 ' ing

ing hot out of the Copper, on the Ashes contained in the first Tub; then after a while draw it off at the top; and so continue putting on and drawing off, first at one Tub of Ashes, then at the other, till your Liquor grow clear, and lose the thick turbid colour it had when it went on.

When all the Liquor hath in this manner past through the Ashes of both Tubs, that by this means all its greasy oyl is left behind in the Ashes, you must keep it for the second boyling in a Vessel by it self: in the mean time pour upon your Ashes a sufficient quantity of common Water, very hot, once or twice, to bring away what is remaining of the Liquor in the Ashes.

When you begin the second boyling, put first into the Copper the Water that went last through your Ashes, and as that wasteth, let your strong Liquor drop into the Copper, out of the Tub above described, standing on the side of the Furnace, till the Liquor in the Copper be ready to shoot or crystallise.

Note, That toward the end of your boyling, there will arise great store of Scum and Froth, which must be carefully taken off with a great brass Scummer, made like a Ladle, full of little holes, and usually about that time it lets fall some common Salt to the bottom, which you must take up with the said Scummer; and lay it aside for another use.

To know when the Liquor is ready to shoot into *Peter*, you need but drop a little of it on a knife, or any other cold thing that hath a smooth superficies, and if it coagulate, like a drop of tallow, and do not fall off the knife when it is turned downward, which also may be judged by its hanging like
oyle

oyl to the sides of the Scummer. When the Liquor is brought to this pass, every hundred weight of it containeth about threescore and ten pounds weight of *Peter*.

When you find your Liquor thus ready to shoot, you must with great Iron Ladles lade it out of the Copper into a high narrow Tub for that purpose, which the Workmen call their settling Tub; and when the Liquor is grown so cold, that you can endure your finger in it, you shall find the common or cubick Salt begin to gravulate and stick to the sides of the Tub; then at the Tap, placed about half a foot from the bottom, draw off your Liquor into deep wooden Trays, or Brass-pans, and the cooler the place is where you let them stand to shoot in, the better and more plentifully will the *Salt-peter* be produc'd; but it will be of no good colour till it be refined, but will be part white, part yellow, and some part of it blackish.

The Salt which sticketh to the sides and bottom of the settling Tub is (as I have said) of the nature of common Salt; and there is scarce any *Peter* to be found but is accompanied with it, though no doubt some of this is drawn out of the Ashes by the second Liquors: If it be foul, they refine it by it self, and about *London* sell it at good rates to those that salt Neats Tongues, Bacon, and Collar-Beef; for besides a savory taste, it gives a pleasing red colour to most Flesh that is salted with it. *Pliny* says, *Nitrum obsonia alba & deteriora reddit Olera viridiora*, whether *Salt-peter* doth so, I have not yet tryed.

When the Liquor hath stood two Days and two Nights in the Pans, that part of the Liquor which is

nor

not coagulated, but swims upon the *Peter*, must be carefully poured off, and being mingled with new Liquors, must again pass the Ashes before it be boiled, else it will grow so greasy it will never generate any Salt.

To Refine

SALT-PETER.

AFTER you have made your Copper very clean, put in as much Water as you think will dissolve that quantity of *Peter* you purpose to Refine; when the Water is very hot cast in the *Peter* by little and little, stirring it about with a Ladle, that it may the sooner dissolve; then increase the Fire till your Liquor begin to boil: In the mean time feel with the Scummer, whether there be at the bottom any Salt undissolv'd, and take it out, for it is Common-Salt, and doth not so soon dissolve as the *Peter*; then as the Water boils scim off the Froth that swims at the top of it as fast as it riseth; when it hath boiled to the height that a drop of it will coagulate on a Plate (as hath been said above in the making of *Salt-peter*) then cast in by degrees either a Pint of the strongest Wine-vinegar, or else four Ounces of Allum beaten to powder (some choose burnt Allum) and you shall observe a black Scum to rise on the top of the Liquor, which when you have allowed some time to thicken, you may easily take off with the Scummer; repeat this so often till no more Scum arises. Some do use to throw in a Shovel full of Quick-Lime, and say it makes *Peter*.

the whiter, and Rock the better ; you must take great care all this while the Fire be not too strong, for while this is doing, the Liquor will be apt to boil over, and will not easily be appeased without your great loss.

When this is done, lade out the Liquor into a settling Tub, and cover it over with a Cloth, that it cool not too soon, and within an hour or two, a thick yellow Faces will fall to the bottom of the Tub ; then quickly draw off the Liquor while it is hot, into the shooting Trays or Pans, and do as you did in making *Peter*, saving, that you must cover the Trays with a Cloth, for then the Liquor will begin to shoot at the bottom, which will make the *Peter-Rock* into much fairer Chrystals, than otherwise it would : When no more *Peter* will shoot (which is commonly after two days) pour off the Liquor that swims at the top, and put the *Peter* into a Tub with a hole at the bottom for to drain, and when it is dry, it is fit for use.

The Figure of the Chrystals is sexangular, and if it hath rightly shot, is fistulous and hollow like a Pipe.

Before I proceed to tell you, how this darling of Nature (the very Basis and Generation of Nutriment) is converted into Gun-powder (the most fatal Instrument of Death that ever Mankind was trusted withal) I will crave leave to acquaint you with a few Speculations I have of this Salt, which if I could clearly make out, would lead us into the knowledge of many noble Secrets in Nature ; as also to a great improvement in the Art of making *Salt-peter*.

First then you are to observe, that though *Peter* go alway in Gun-powder, yet if you fulminate it

in a Crucible, and burn off the volatile part with Powder of Coal, Brimstone, Antimony or Meal, there will remain a Salt, and yet so fixed (very unlike Common-Salt) that it will endure the force of almost the strongest Fire you can give it; which being dissolved into Water and Spirit of *Nitre* dropped into it, till it give over hissing (which is the same with the volatile Part that was separated from it in the fulmination) it will be again reduced to Chrystals of *Peter*, as it was at first; which noble Experiment the World hath already been taught by an honourable Member of this Society; with a train of such important Observations, as never before were raised from one Experiment.

That which I aim at then is, that if the Spirit of the volatile Salt of Soot, or of the Urine, Blood, Horns, Hoofs, Hair, Excrements, or indeed any part of Animals (for all abound with such a volatile Salt fixed, and Oyl as *Peter* doth) could by the same way, or any like it, be reduc'd to *Peter* or some *Nitrous* Salt not much differing from it: It would excellently make out a Theory that I am much delighted with, till I am convinced in it; which is, that the Salt which is found in Vegetables and Animals, is but the *Nitre* which is so universally diffused through all the Elements (and must therefore make a chief Ingredient in their Nutri-ment, and by consequence of their Generation) a little altered from its first Complexion: And that the reason why Animals that feed on Vegetables are obliged by Nature to longer meals than those that feed on other Animals, is, because Animals are fuller of that Salt than Vegetables: And indeed such Animals are but Caterers of it for Man;

M m 2

and

‘ and others whom Nature’s bounty gratifies with a
 ‘ more lusty and delicious Diet.

‘ I confess I have been the more confirmed in this
 ‘ fancy, since I have often seen a Friend of mine,
 ‘ with a Natural and Facile *Exercitia* convert the
 ‘ greater part of *Peter* into a Salt so like the Vola-
 ‘ tile Salt of Urine, that they are scarce to be distin-
 ‘ guished by smell or taste, and yet he adds nothing
 ‘ to it that can possibly be suspected to participate of
 ‘ that Nature: But indeed all Volatile Salts are so
 ‘ alike, that it is not easy to distinguish them in any
 ‘ respect.



T H E

HISTORY

Of Making

GUN-POWDER.

THE materials of *Gun-powder* are *Salt-peter*, *Brimstone*, and *Coal*; the *Peter* and *Brimstone* must be both refined if you mean to make good *Powder*, and the *Coal* must be *Withy* and *Alder* equal parts; for *Withy* alone is counted too soft, and some do commend *Hazle* alone to be as good as the other two.

The whole Secret of the Art consists in the proportion of the Materials, the exact mixture of them, that in every the least part of *Powder* may be found all the Materials in their just proportion; then the Corning or making of it into Grains; and lastly the Drying and Dusting of it.

The proportion is very differently set down by several Authors; *Baptista Porta* tells us the ordinary *Powder* is made of four Parts of *Peter*, one of *Sulphur*, and one of *Withy* Coal: But the best *Powder* of 6, or 8 of *Peter*, and one a piece of the other, which agrees pretty well with *Bonfadini* a late *Italian* Writer, in his Book of the Art of *Shooting flying*, where, to make the best *Gun-powder*, he prescribes seven Parts of *Peter*, one of *Brimstone*, and of *Hazel* Coal an ounce less in every pound: *Cardan* says; *Constat ex tribus Halinitri partibus, duabus Saligni*

‘ *Saligni Carbonis atque una Sulphuris, Convenitque*
 ‘ *magnis Machinis; Sed Midiocribus Halinitri par-*
 ‘ *tes decem, Saligni carbonis tres, Sulphuris duas, par-*
 ‘ *vis vero Halinitri partes decem; Carbonis ligni nu-*
 ‘ *cis Avellonæ sine nodis, tum Sulphuris partem unam*
 ‘ *singularem: Langius appoints three of Peter, two*
 ‘ *of Withy Coal, and one of Brimstone: The Eng-*
 ‘ *lish Author of Fire-works, says, that the proportions*
 ‘ *in England to make good, indifferent, and ordinary*
 ‘ *Powder, is 5, 4, and 3 parts of Peter, to two of*
 ‘ *Coal, and one Brimstone. Our English Workmen*
 ‘ *are generally so curious of their secret, that I could*
 ‘ *not obtain the proportion of them without a pro-*
 ‘ *mise of Secrecy: But when all is done their secret*
 ‘ *is not so much the way to make the best Powder,*
 ‘ *as the best way to get most money by it, by subtract-*
 ‘ *ing from the Peter, and making up weight with*
 ‘ *the Coal; when indeed there is so great a Latitude,*
 ‘ *that provided the Materials be perfectly mixt, you*
 ‘ *make good Powder with any of the proportions*
 ‘ *above-mention’d; but the more Peter you allow it,*
 ‘ *it will still be the better, till you come to observe*
 ‘ *eight Parts.*

‘ The next thing after the proportion, is the mix-
 ‘ ture, about which most of the workmens time and
 ‘ pains is bestowed: For first in a Horse-mill with
 ‘ two stones (like that with which they grind their
 ‘ Materials at the *Glass-house*) moving upon a Mar-
 ‘ ble bottom, which is edged with boards set sloap-
 ‘ ing, that what slips from under the stones may slide
 ‘ back again.

‘ They grind the Brimstone and Coal each of them
 ‘ apart by themselves as fine as possibly they can;
 ‘ then they sift each of them apart by themselves:

‘ The

The Brimstone is sifted thorough Tiffany in a Bolt-
ing mill, such as the Bakers use for Wheat-flour :
the Coal is sifted thorough Lockram, in a bag made
like a shirt sleeve; for the convenience of the
Work-man it is done in a close Bin, with only two
holes for him to put his arms in, and shake the bag
about. Whatsoever of each material is not small
enough to sift thorough, is brought again to the Mill
to be new ground.

As for the *Peter*, that must in the Copper be dissol-
ved in as much water as will just take it up, and then
the water must be boiled away till the *Peter* comes
to the thickness of hasty-pudding. The reason of
this operation is because when the *Peter* is thus soft,
the other materials will the easilier incorporate with
it, and in the next place it will not wear the wooden
pestles so much when it comes to the Mill, as when
it is hard and dry.

When the Materials are in this readiness, they
are weighed (only the *Peter* is weighed before it is
put to dissolve in the Copper) and by proportion
are carried to the mingling Trough, which is made
of boards, like a great Chest without a cover, being
about eight foot long, four broad, and three foot high.
The Coal is laid in first, the Brimstone next, and the
Peter at top of all; then two men with shovels stir
and mingle them together for an hour, and then 'tis
ready for the Mill.

The Powder-mills are seldom made to move
with any thing but water: The great water-wheel
is made like that of an ordinary water-wheel, ei-
ther over-shot or under-shot, according to the
quantity of water they have: To the *Axis* of this
wheel, a little way within the Mill is fastened a
lesser

' lesser wheel, called the Spar-wheel, with strong
 ' Cogs, which in their motion round take hold of
 ' the round staves of another wheel of about the
 ' same diameter, set a little way above it, and fastned
 ' to the end of a beam of 15 or 16 foot long, laid
 ' parallel to the Horizon, with an iron gudgeon at
 ' the other end of it, to facilitate its motion round :
 ' This beam is called the round beam ; out of it come
 ' a certain number of arms of about nine inches long,
 ' and three inches broad, which in their going round
 ' meet with other lesser arms (called Tapes) coming
 ' out of the Pestles (for so they call certain small quar-
 ' ters of Timber placed perpendicular to the Horizon,
 ' about nine foot long and four inches broad ; they
 ' are set in a slight frame to keep them steady) ; by
 ' these small arms the Pestles are lifted up about two
 ' foot and a half, and then let fall into a strong wood-
 ' en Trough set under them, wherein the Powder is
 ' put to be pounded.

' Every Mill hath two Troughs, and about sixteen
 ' Pestles : every Pestle hath fastned to the lower end
 ' of it a round piece of *Lignum Vitæ*, of about five
 ' inches long and three and a half diameter ; and in-
 ' to the bottom of the Trough, just where the Pestle
 ' is to fall, is let in another piece of *Lignum Vitæ*,
 ' of the fashion and bigness of an ordinary Bowl,
 ' split according to its longest diameter : The Pestles
 ' are not lifted up all together, but alternatively, to
 ' make the Powder turn the better in the working ;
 ' and for the same reason round Troughs are counted
 ' better than square.

' To make excellent Powder, it ought to be
 ' wrought thus thirty hours ; but of late they will
 ' not afford it above eighteen or twenty hours ; once
 ' in

in eight hours they use to moisten the Powder with a little fair Water ; others, who are more curious, put Water something thickned with quick-lime ; others use White-wine Vinegar, others *Aqua-vitæ* : But if it be not moistned with something once in eight hours, the Powder will grow dry, and in half an hour after it will take fire. As soon as the Powder grows dry, you may find it, though at a distance, by the noise of the Mill ; for then the Pestles will rebound from the bottom of the Trough and make a double stroke. The only danger to the Mill is not from the Trough ; for many times the iron Gudgeons grow hot for want of greasing, and then the Dust that flies about will be apt to fire, and so the Mill blows up.

From the Mill the Powder is brought to the Corning-house, of a middle temper between moist and dry. The way of corning it is with two hair Sieves join'd together, the upper Sieve inclosing some part of the Hoop of the lower Sieve : The upper Sieve hath holes of the size you will have the Powder grained at ; the holes of the lower Sieve are much lesser : The upper Sieve they call their corning Sieve, the lower their wet Duster : They lay the Powder upon the upper Sieve some two inches thick ; upon that a Piece of heavy wood made like a Trencher, of about eight inches diameter, and two and a half in thickness, called a Runner, which when the Sieve is moved, by its weight and motion, forces the Powder thorough the upper Sieve, and that corns it. Then the lower Sieve receives the Powder, and lets the dust go thorough the Bin, over which the Sieve is shaken, called the Dustingin.

‘ When the Powder is thus corned, it is laid about
 ‘ an inch and half thick on the drying Sieves, which
 ‘ are made of coarse Canvass fastned to slight frames
 ‘ of Deal about an Ell long, and some twenty-inches
 ‘ broad ; and thus it is carried into Stoves to dry.

‘ The Stove is commonly a little Room about
 ‘ eighteen or twenty foot square, with ranges of small
 ‘ Fir poles about two foot one above another, to lay
 ‘ the drying Sieves upon, but only on that side the
 ‘ fire is made. Besides a glass window to give light,
 ‘ there must be a small lover-hole, at the top of the
 ‘ Room, to let out the steam, else the Powder will
 ‘ not only be the longer a drying, but often by the re-
 ‘ turn of the steam on the Sieves, the top of the Pow-
 ‘ der will be so crufted that the lower part will not dry.
 ‘ The Room is heated by an Iron about a yard high
 ‘ and half a yard broad, cast in the form of an Arch,
 ‘ equal to a Semi-quadrant, and placed in the back
 ‘ of a Chimney, the fore-part whercof is like a Fur-
 ‘ nace ; and to avoid danger, opens into another little
 ‘ Room apart, called the Stoke-hole.

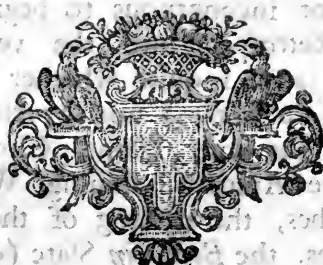
‘ The Powder is brought into the Stove before it
 ‘ be heated, and is not taken out again till the Stove
 ‘ be cold ; and about eight hours is required to the
 ‘ drying of it. In hot Countries the Sun is the best
 ‘ Stove, and a great deal of danger and charges that
 ‘ way avoided.

‘ After the Powder is dried, it is brought again to
 ‘ the Corning-house, where it is again sifted over
 ‘ the Dusting bin in other double Sieves, but without
 ‘ any Runners. These Sieves have both of them
 ‘ smaller holes than the former : The upper Sieve is
 ‘ called the Separator, and serves to divide the great
 ‘ corns from the lesser ; the great corns are put by
 them-

‘ themselves, and serve for Cannon Powder. The
 ‘ lower Sieve is called the Dry-duster, and retains
 ‘ the small corns (which serve for Musquet and Pistol)
 ‘ and lets fall the dust into the Bin, which is to be
 ‘ mingled with fresh Materials, and again wrought
 ‘ over in the Mill.

‘ So that good Powder differs from bad (besides
 ‘ the well working and mingling of the Materials) in
 ‘ having more *Peter* and less Coal; and lastly, in the
 ‘ well dusting of it.

‘ The last Work is to put the Powder into Barrels;
 ‘ every Barrel is to contain five score weight of Pow-
 ‘ der, and then ’tis ready for sale.



N n 2

AN

A N

A P P A R A T U S

T O T H E

H I S T O R Y

Of the Common Practices of

D Y I N G.

By Sir *WILLIAM PETTY*.

‘ IT were not incongruous to begin the History with a Retrospect into the very nature of Light it self (as to inquire whether the same be a Motion or else a Body;) nor to premise some Theorems about the Sun, Flame, Glow-worms, the Eyes of some Animals, shining Woods, Scales of some Fishes, the dashing of the Sea, strokes upon the Eyes, the *Bolonian* Slate (called by some the Magnet of Light) and of other light and lucid Bodies.

‘ It were also not improper to consider the very essentials of Colour and Transparencies (as that the most transparent Bodies, if shaped into many angles, present the Eye with very many colours;) That bodies having but one single superficies, have none at all, but are fuscipient of every colour laid before

‘ before them; That great depths of Air make a
 ‘ Blue, and great depths of Water a Greenish colour;
 ‘ That great depths or thicknesſes of coloured Liquors
 ‘ do all look blackiſh (red Wine in a large conical
 ‘ Glaſs being of all reddiſh colours between Black at
 ‘ the top and White at the bottom.

‘ That moſt Vegetables, at one time or other, are
 ‘ greeniſh; and that as many things paſſing the Sun
 ‘ are blackned, ſo many others much whitened by
 ‘ the ſame: Other things are whitened by acid
 ‘ Fumes, as red Roſes and raw Silks by the ſmoak of
 ‘ Brimſtone.

‘ Many Metals, as Steel and Silver, become of
 ‘ various colours, and tarniſh by the Air, and by ſe-
 ‘ veral Degrees of heat.

‘ We might conſider the wonderful variety of co-
 ‘ lours appearing in Flowers, Feathers; and drawn
 ‘ from Metals, their Calces and Vitrifications; and of
 ‘ the Colours riſing out of transparent Liquors artifi-
 ‘ cially mixed.

‘ But theſe things, relating to the abſtracted nature
 ‘ of Colours, being too hard for me, I wholly de-
 ‘ cline; rather paſſing to name (and but to name),
 ‘ ſome of the ſeveral ſorts of Colorations now com-
 ‘ monly uſed in Humane affairs, and as vulgar Trades
 ‘ in theſe Nations; which are theſe; viz.

1. ‘ There is a whitening of Wax, and ſeveral ſorts
 ‘ of Linnen and Cotton Cloths, by the Sun, Air,
 ‘ and by reciprocal effuſions of Water.

2. ‘ Colouring of Wood and Leather by Lime,
 ‘ Salt, and Liquors, as in Stayes, Canes, and Marble
 ‘ Leather.

3. ' Colouring of Paper, *viz.* Marbled Paper, by
' distempering the colours with Ox-gall, and apply-
' ing them upon a stiff gummed Liquor.
4. ' Colouring, or rather discolouring the Colours
' of Silks, Tiffanies, &c. by Brimstone.
5. ' Colouring of several Iron and Copper-work,
' into Black, with Oyl
6. ' Colouring of Leather into Gold-colour, or
' rather Silver leaves into Gold by Varnishes, and in
' other cases by Urine and Sulphur.
7. ' Dying of Marble and Alabaſter with heat and
' coloured Oyls.
8. ' Colouring Silver into Braſs with Brimstone or
' Urine.
9. ' Colouring the Barrels and Locks of Guns into
' Blue and Purple with the temper of Small-coal
' heat.
10. ' Colouring of Glaſs (made of Sands, Flints,
' &c.) as alſo of Chryſtals and Earthen Ware, with
' the ruſts and ſolutions of Metals.
11. ' The colouring of live Hair, as in *Poland*,
' Horſe and Man's Hair; as alſo the colouring of
' Furrs.
12. ' Enameling and Annealing.
13. ' Applying Colours, as in the Printing of
' Books and Pictures, and as in making of playing
' Cards; being each of them performed in a ſeveral
' way.
14. ' Gilding and Tinning with *Mercury*, *Block-*
' *Tin*, *Sal-Armoniack*.
15. ' Colouring Metals, as Copper with *Calamy*
' into Braſs, and with *Zink* or *Spelter* into Gold, or
' into Silver with *Arsenick*: And of Iron into Cop-
' per with *Hungarian Vitriol*.

16. ' Making Painter's Colours by preparing of
' Earth, Chalk, and Slates; as in *Umber*, *Oker*, *Cul-*
' *len earth*, &c. as also out of Calces of Lead, as
' *Ceruse* and *Minium*; by Sublimates of Mercury and
' Brimstone, as in *Vermilion*; by tinging of white
' Earths variously, as in *Verdeter*, and some of the
' *Lakes*; by concrete Juices or *Fæcula*, as in *Gam-*
' *brugium*, *Indico*, *Pinks*, *Sap-green*, and *Lakes*:
' As also by Rusts, as in *Verdegrees*, &c.

17. ' The applying of these Colours by the adhesi-
' on of Ox-gall, as in the Marble Paper aforesaid; or
' by Gum-water, as in Linning; or by clammy dry-
' ing Oyls, (such as are the Oyls of Linseed, Nuts,
' Spike, Turpentine, &c.)

18. ' Watering of *Tabbies*.

19. ' The last I shall name is the colouring of
' Wool, Linnen, Cotton, Silk, Hair, Feathers, Horn,
' Leather, and the Threads and Webbs of them with
' Woods, Roots, Herbs, Seeds, Leaves, Salts, Limes;
' Lixiviums, Waters, Heats, Fermentations, Macera-
' tions, and other great variety of Handling: An ac-
' count of all which is that History of Dying we in-
' tend. All that we have hitherto said being but a
' kind of remote and scarce pertinent Introduction
' thereunto.

' I begin this History by enumerating all the seve-
' ral Materials and Ingredients which I understand
' to be or to have been used in any of the last afore-
' mentioned Colorations, which I shall represent in
' various Methods, viz. out of the *Mineral* Family.
' They use Iron and Steel, or what is made or comes
' from them, in all true Blacks (called *Spanish* Blacks);
' though not in *Flanders* Blacks; viz. they use Cop-
' peras, Steel-filings, and Slippe, which is the stuff
' found

‘ found in the Troughs of Grind-stones, whereon
 ‘ Edge-tools have been ground. They also use Pew-
 ‘ ter for Bow-dye, Scarlet, *viz.* they dissolve Bars of
 ‘ Pewter in the *Aqua-fortis* they use; and make also
 ‘ their Dying-kettles or Furnace of this Metal.

‘ *Litharge* is used by some, though acknowledged
 ‘ by few, for what necessary reason I cannot learn,
 ‘ other than to add weight unto Dyed Silk; *Litharge*
 ‘ being a Calx of Lead, one of the heaviest and most
 ‘ colouring Metals.

‘ I apprehend *Antimony* much used to the same
 ‘ purpose, though we know there be a very tingent
 ‘ Sulphur in their Mineral, which affordeth variety of
 ‘ Colour by the precipitations and other operations
 ‘ upon it.

‘ *Arsenick* is used in Crimson upon pretence of gi-
 ‘ ving Lustre, although those who pretend not to be
 ‘ wanting in giving Lustre to their Silks, do utterly dis-
 ‘ own the use of *Arsenick*.

‘ *Verdegrease* is used by Linnen Dyers in their
 ‘ Yellow and Greenish Colours, although of itself it
 ‘ strike not deeper Colour than of pale Straws.

‘ Of *Mineral Salts* used in *Dying*; the chief is
 ‘ Allum; the very true use thereof seems to me obscure
 ‘ enough, notwithstanding all the Narrations I could
 ‘ get from Dyers about it: For I doubt;

‘ Whether it be used to make common Water
 ‘ a fit *Menstruum*, wherewith to extract the Tinging
 ‘ particles of several hard Materials; for I find Al-
 ‘ lum to be used with such Materials as spend easy
 ‘ enough, as Brasil, Logwood, &c. And withal,
 ‘ that the Stuffs to be dyed are first boyled in Allum-
 ‘ Liquors, and the Allum afterwards (as they say)
 ‘ cleared from the said Stuff again, before any Colour
 ‘ at all be apply’d.

2. ‘ Whe-

2. ' Whether it be used to scour the *Sordes*, which
' may interpose between the *Coloranda*, and the Dy-
' ing Stuff; and so hinder the due adhesion of the
' one unto the other: The boyling of several things
' first in Allum seeming to tend this way. But I find
' this work to be done in Cloth, and Rugs, by a due
' scouring of the same in the Fulling-mills with Earth,
' and in Silk with Soaps, by which they boyl out the
' Gums and other *Sordes*, hindring or vitiating the
' intended Colours.

3. ' Whether Allum doth intenerate the Hairs of
' Wool, and Hair-stuff, as Grograins, &c. Whereby
' they may the better receive and imbibe their Co-
' lours? Unto which opinion I was led by the Dy-
' ers; saying, that after their Stuffs were well boyled
' in Allum, that they then cleared them of the Al-
' lum again: But we find the most open bodied Cot-
' tons and Silks, to have Allum used upon them; as
' well as the harder Hairs. Nor is Allum used in
' many Colours, *viz.* in no Woad or Indico Blues;
' and yet the Stuffs dyed Blue, are without any pre-
' vious inteneration quickly tinged; and that with
' a slight and short immersion thereof into the Blue-
' fat.

4. ' Whether it contribute to the Colour it self, as
' Copperas doth to Galls, in order to make a Black;
' or as Juice of Lemons doth to Cochineel in the
' *Incarnadives*; or as *Aqua-fortis* impregnated with
' Pewter, doth in the Bow-Scarlet, changing it from
' a red Rose-Crimson to Flame-Colour. This use is
' certainly not to be denied to Allum in some cases;
' but we see in other cases, that the same Colours may
' be dyed without Allum, as well as with it, though
' neither so bright and lively, nor so lasting.

O O

5. ' Where-

5. ' Wherefore, Fifthly, I conclude (as the most
 ' probable opinion) that the use of Allum is to be a
 ' *Vinculum* between the Cloth and the Colour, as
 ' clammy Oyls and Gum-waters are in Painting and
 ' Limning; Allum being such a thing, whose parti-
 ' cles and *Aculei* dissolved with hot Liquors will stick
 ' to the Stuffs, and pitch themselves into their Pores;
 ' and such also, as on which the particles of the dy-
 ' ing Drugs will also catch hold, as we see the parti-
 ' cles of Copperas and other chrySTALLIZING materials,
 ' do of Boughs and Twigs in the Vessel, where such
 ' ChrySTALLIZATION is made. A second use I imagine
 ' of Allum in Dying, to be the extracting or drying
 ' up of some such particles, as could not consist with
 ' the Colour to be superinduced; for we see Allum is
 ' used in the dressing of *Alutas* or white Leather, the
 ' which it dryeth, as the Salt of Hen-dung doth in Ox-
 ' hides, and as common Salt doth in preservation of
 ' Flesh-meats; for we know, a Sheep-skin newly flay-
 ' ed could not be colour'd as Brasils are, unless it
 ' were first dressed into Leather with Allum, &c. which
 ' is necessary to the Colour, even although the Allum
 ' be, as it is, cleared out of the Leather again, before
 ' the said Colouration, with Bran, Yolks of Eggs, &c.
 ' Wherefore as Allum, as it were by accident, makes
 ' a wet raw Skin to take a bright Colour, by extracting
 ' some impedimental particles out of it; so doth it
 ' also out of other materials, though perhaps less dis-
 ' cernably.

' Another use I suppose of Allum, which is to
 ' brighten a Colour: For as we see the finest and
 ' most glassy materials to make the most orient
 ' Colours, as Feathers, Flowers, &c. so certainly
 ' if by boyling Cloth in Allum, it become incrusta-

' ted

ted with particles, as it were of Glass, the tinging of them yields more brightness, than the tinging of a Scabrous matter (such as unallumed Cloth is) can do. Analogous hereunto I take the use of Bran, and Bran-liquors in Dying to be; for Bran yielding a most fine Flour (as we see in the making of white Starch;) I conceive that this Flour entring into the pores of the Stuff, levigates their *Superficies*, and so makes the Colour laid on it, the more beautiful, just as we see, that all woods, which are to be gilded, are first smoothened over with white Colours, before the Gold be laid on.

And indeed all other Woods are filled, not only as to their greater holes and Asperities, with *Putty*; but also their smaller Scabrities are cured by priming Colours, before the ultimate Colour intended be laid thereon.

The next Mineral Salt is *Salt-peter*, not used by ancient Dyers, and but by few of the modern. And that not till the wonderful use of *Aqua-fortis* (whereof *Salt-peter* is an ingredient) was observed in the Bow-scarlet: Nor is it used now, but to brighten Colours by back-boyling them; for which use *Argol* is more commonly used. Lime is much used in the working of Blue-fats, being of Lime-stone calcined, and called *Calke*, of which more hereafter.

Of the *Animal* Family are used about Dying, Cochineel (if the same be any part of an *Animal*) Urine of labouring Men, kept till it be stale and stinking; Honey, Yolks of Eggs, and Ox-gall. The three latter so rarely, and as the conceits of particular Workmen; and for collateral uses (as to increase weight, promote fermentation, and to scour, &c.) that I shall say very little more of them

' in this place, only saying of Urine, that it is used to
 ' scour, and help the fermenting and heating of
 ' Woad; it is used also in the Blue-fats instead of
 ' Lime: It dischargeth the yellow (of which and
 ' blue, most greens are compounded) and therefore
 ' is always used to spend *Weld* withal. Lastly, the
 ' stale Urine, or old Mud of pissing places, will
 ' colour a well scoured small piece of Silver into a
 ' Golden colour, and it is with this (and not at all
 ' with the *Bath-water*) wherewith the Boys at *Bath*
 ' colour single pence; although the generality be-
 ' lieve otherwise. Lastly, it seems to me that Urine
 ' agreeth much in its Nature with *Tartarous Lixi-*
 ' *via*; not only because Urine is a Lye made of Ve-
 ' getables in the body of *Animals*; nor because in
 ' the Receptacles of Urine, *Tartarous* stones are bred
 ' like as in Vessels of Wine; nor because Urine dis-
 ' charges and abrades Colours as the *Lixivia* of *Tar-*
 ' *tar*, or the deliquated Salts of *Tartar* do; but be-
 ' cause *Tartar* and *Sulphur-Lixivia* do colour the
 ' superficies of Silver, as we affirmed of Urine; and
 ' the difference I make between Urine and *Tarta-*
 ' *rous-Lixivia* is only this, that though the Salts of
 ' both of them seem by their effects in Dying, in a
 ' manner the same; yet that Urine is made and con-
 ' sists of Salt and Sulphur both.

' Before we enter upon the *Vegetable* materials for
 ' Dying, we may interpose this Advertisement, That
 ' there are two sorts of Waters used by Dyers, *viz.*
 ' River-water and Well-water: By the latter I mean
 ' in this place the Pump-water in great Cities and
 ' Towns, which is a harsh Water wherewith one can
 ' scarce wash ones hands, much less scour them clean;
 ' nor will Soap dissolve in it, but remains in rolls and
 ' lumps.

lumps: moreover, the Flesh boyled in it becomes hard and reddish. The Springs rising out of large covered spaces (such as are great Cities) yield this Water, as having been percolated thorough more ground than other Water, and consequently been divested of its fatty earthy particles, and more impregnated with saline substances in all the way it hath passed. The Dyers use this Water in Reds, and in other Colours wanting restringency, and in the dying of Materials of the slacker Contextures, as in Callico, Fustian, and the several species of Cotton-works. This Water is naught for Blues, and makes Yellows and Greens look rusty.

River-water is far more fat and oily, sweeter, bears Soap; that is, Soap dissolves more easily in it, rising into froth and bubbles, so as the Water thickens by it. This Water is used in most cases by Dyers, and must be had in great quantities for washing and rinsing their Cloaths after Dying.

Water is called by Dyers White Liquor; but there is another sort of Liquor called Liquor absolutely, and that is their Bran-liquor, which is one part of Bran and five of River-water, boyled together an hour, and put into leaden Cisterns to settle. This Liquor when it turns sour is not good; which sourness will be within three or four Days in the Summer-time. Besides the uses afore-named of this Liquor, I conceive it contributes something to the holding of the Colour; for we know Starch, which is nothing but the flour of Bran, will make a clinging Paste, the which will conglutinate some things, though not every thing; viz. Paper, though neither Wood nor Metals. Now Bran-liquors are used to mealy dying Stuffs, such as *Mather* is, being the

‘ the Powder or *fecula* of a Root; so as the flour
 ‘ of the Bran being joyned with the *Mather*, and
 ‘ made clammy and glutinous by boyling, I doubt not
 ‘ but both sticking upon the *villi* of the Stuff dyed,
 ‘ the *Mather* sticks the better by reason of the starchy
 ‘ pastiness of the Bran-flour joyned with it.

‘ Gums have been used by Dyers about Silk, *viz.*
 ‘ *Gum Arabick*, *Gum Dragant*, *Mastick*, and *San-*
 ‘ *guis Draconis*. These Gums tend little to the
 ‘ tincture of the said Silk, no more than Gum doth
 ‘ in ordinary writing Ink, which only gives it a con-
 ‘ sistence to stay just where the Pen delivers it, without
 ‘ running abroad uncertainly: So Gum may give the
 ‘ Silk a glassiness, that is, may make it seem finer, as
 ‘ also stiffer; so as to make one believe the said stiff-
 ‘ ness proceeded from the quantity of Silk close wo-
 ‘ ven: And lastly, to increase weight; for if an
 ‘ ounce of Gum, worth a penny, can be incorporated
 ‘ into a pound of Silk, the said penny in Gum produ-
 ‘ ceth three Shillings, the price of an Ounce of Silk.
 ‘ Wherefore we shall speak of the use of each of the
 ‘ said four Gums, rather when treating of Sising and
 ‘ Stiffening, than now in a Discourse of Dying, where
 ‘ also we may speak of Honey and Molasses.

‘ We refer also the Descriptions of Fullers-earth,
 ‘ Soaps, Linseed-oyl, and Ox-galls, unto the head of
 ‘ Scouring, rather than to this of Dying.

‘ Wines and *Aqua-vitæ* have been used by some
 ‘ particular Artists; but the use of them being nei-
 ‘ ther constant nor certain, I omit further mention
 ‘ of them. The like I say of Wheaten-flour and
 ‘ Leaven.

‘ Of *Cummin-seed*, *Fenugreek-seed*, *Senna*, and *Ag-*
 ‘ *rick*, I have as yet no satisfactory account.

‘ Ha-

‘ Having spoken thus far of some of the Dying
‘ stuffs, before I engage upon the main, and speak
‘ more fully of those which have been but slightly
‘ touched upon already, I shall more synoptically here
‘ insert a Catalogue of all Dying Materials; as well
‘ such as I have already treated upon, as such as I in-
‘ tend hereafter to describe.

‘ The three peculiar Ingredients for Black are Cop-
‘ peras, filings of Steel, and Slippe.

‘ The Restraining binding Materials are Alder Bark,
‘ Pomegranet Pills, Walnut rinds and roots, Oaken
‘ Sapling Bark, and Saw-dust of the same; Crab-
‘ tree Bark, Galls, and Sumach.

‘ The Salts of Allum, Argol, Salt-peter, *Sal-Ar-*
‘ *moniack*, Pot-ashes, and Stone-Lime, unto which
‘ Urine may be enumerated as a liquid Salt.

‘ The Liquors are Well-water, River-water, Wine,
‘ *Aqua-vitæ*, Vinegar, Juyce of Lemon, and *Aqua-*
‘ *fortis*: There is Honey used, and Molasses.

‘ Ingredients of another *Classis* are Bran, Wheaten-
‘ flour, Yolks of Eggs, Leaven, Cummin-seed, Fe-
‘ nugreek-seed, Agarick, and Senna.

‘ Gums are *Gum Arabick*, *Dragant*, *Mastick*, and
‘ *Sanguis Draconis*.

‘ The Smecticks or Abstersives are Fuller’s-earth,
‘ Soap, Linseed-oyl, and Ox-gall.

‘ The other Metals and Minerals are Pewter, Ver-
‘ degrease, Antimony, Litharge, and Arsenick.

‘ But the *Colorantia colorata* are of three sorts, *viz.*

‘ Blue, Yellow, and Red; of which Logwood, old
‘ Fustick, and Mather, are the *Polycaresta* in the pre-
‘ sent and common practices, being one of each sort.

‘ The Blues are Woad, Indico and Logwood: The Yel-
‘ lows are Weld, Wood-wax, and old Fustick, as also

‘ Tur-

‘ Turmerick, now seldom used : The Reds are Red-wood, Brazil, Mather, Cochincel, Safflowrs, Kermes-berries, and Sanders ; the latter of which is seldom used, and the Kermes not often. Unto these *Arnotto* and young Fustick, making Orange-colours, may be added, as often used in these times.

‘ In Cloth Dying, wood-foot is of good use.

‘ Having presented this Catalogue, I come now to give or enlarge the Description and Application of some of the chief of them, beginning with Copperas.

‘ Copperas is the common thing used to dye Blacks withal, and it is the salt of the *Pyrites* stone, where- with old Iron (having been dissolved in it) is incorporated. The filings of Steel, and such small particles of Edge-tools as are worn away upon the Grindstone, commonly called Slippe, is used to the same purpose in Dying of Silks (as we said before) which I conceive to be rather to increase the weight than for any other necessity ; the particles of Copperas being not so heavy and crass as these are : for else why should not these latter-named Materials be as well used about Cloth, as other cheaper stuffs ?

‘ We observe, that green Oaken-boards by the affric- tion of a Saw become black ; and that a green four Apple cut with a knife, becomes likewise black ; and that the white grease wherewith Coach-wheels are anointed, becomes likewise black, by reason of the Iron boxes wherewith the Nave is lined, besides the ustulation or affrication between the Nave and the Axel-tree. Moreover we observe, that an Oaken- stick, by a violent affrication upon other wood in a Turning-Lath, makes the same black

From all which we may observe, That the whole
business of Blacking lies in the Iron, as if the salt of
the *Pyrites*-stone in Copperas served only to ex-
tract the same; and withal it seems to lie in a kind
of singeing and ustulation, such as rapid affrictions
do cause: For Allum seems to be of the same na-
ture with Vitriol; and yet in no case that I know
of, is used for black colours: And in the black co-
lour upon earthen Ware is made with scalings of
Iron vitrified. Note, That where-ever Copperas is
used, either Galls, Sumach, Oak Sapling-barks, Al-
der-bark, Walnut-rinds, Crabtree-bark, or green Oak
saw-dust, must be used with it: All which things
Physicians call Austere and Stiprick.

Red-wood must be chopt into small pieces, then
ground in a Mill between two heavy stones, as corn
is. It is used also in Dying of Cloth and Rugs, and
those of the Coarser sort: The colour is extracted
with much and long boyling, and that with Galls.
The colour it makes is a kind of Brick-colour Red;
it holdeth much better than Brasil. The Cloth it
dyeth is to be boyled with it: Wherefore only such
matters as are not prejudiced by much boyling are
died herewith.

Brasil is chopt and ground like as the Red-wood:
It dyeth a Pink-colour or Carnation, imitating the
colour of Cochineil the nearest: It is used with
Allum for the ordinary colour it dyeth; and with
addition of Pot-ashes, when it is used for Purples.

Brasil steeped in Water giveth it the colour of Clar-
ret-wine, into which a drop or two of Juyce of
Lemons or Vinegar being put, turneth it into the
colour of Canary-Sack; in which particular it a-
greeth with Cochineil. This colour soon staineth;

‘ as may appear by the easy change which so small a
 ‘ quantity of acid liquor makes upon it. A drop of
 ‘ Spirit of Vitriol turneth the infusion of Brasil into a
 ‘ purplish violet-colour, even although it hath been
 ‘ made yellow before, by the addition of Juyce of
 ‘ Lemons or Vinegar; and is the same effect which
 ‘ Pot-ashes also produce, as we said before.

‘ *Mather* is a Root cultivated much in *Flanders* :
 ‘ There be of it two sorts; *Pipe-Mather*, which is
 ‘ the coarsest; and *Bale-Mather*, otherwise called
 ‘ *Crap-Mather* : This *Mather* used to the best advan-
 ‘ tage, dyeth on Cloth a colour the nearest to our
 ‘ Bow-dye, or the new Scarlet; the like whereof
 ‘ Safflower doth in Silk, insomuch as the colours cal-
 ‘ led Bastard-Scarlets are dyed with it. This colour
 ‘ indures much boyling, and is used both with Allum
 ‘ and Argol : it holdeth well. The brightest colours
 ‘ dyed with this material are made by over-dying the
 ‘ same, and then by discharging part of it by back-
 ‘ boyling it in Argol.

‘ *Mather* is used with Bran-liquor, instead of White-
 ‘ liquor, or ordinary Water.

‘ *Cochineil* is of several sorts, viz. *Silvester* and
 ‘ *Mestequa* : This also is used with Bran-liquor in Pew-
 ‘ ter-Furnaces, and with *Aqua-fortis*, in order to the
 ‘ Scarlet dye. It is the colour whereof the like quan-
 ‘ tity effecteth most in Dying; and Colours dyed
 ‘ with it, are said to be dyed in Grain. Rags dyed
 ‘ in the dregs of this colour is called *Turnsole*, and ’tis
 ‘ used to colour Wines; *Cochineil* being counted so
 ‘ far from an unwholesome thing, that it is esteemed a
 ‘ Cordial. Any acid Liquor takes off the intense
 ‘ Redness of this colour; turning it towards an O-
 ‘ range, Flame, or Scarlet colour : With this colour

‘ also

‘ also the *Spanish* Leather and Flocks are dyed which
 ‘ Ladies use. The extract or *secula* hereof makes the
 ‘ finest *Lake*.

‘ *Arnotto* dyeth of it self an Orange-colour, is used
 ‘ with Pot-ashes upon Silk, Linnen, and Cottons,
 ‘ but not upon Cloth, as being not apt to penetrate in-
 ‘ to a thick substance.

‘ *Weld*, called in Latin *Luteola*; when it is ripe
 ‘ (that is to say, in the flower) it dyeth (with the help
 ‘ of Pot-ashes) a deep Lemon-colour, like unto *Ra-*
 ‘ *nunculus*, or Broom-flower; and either by the small-
 ‘ ness of proportion put into the Liquor, or else by
 ‘ the slighter tincture, it dyeth all Colours between
 ‘ White and the Yellow aforesaid.

‘ In the use of this material, Dyers use a cross,
 ‘ driven down into their Furnace, with a screw to
 ‘ keep it down, so as the Cloth may have liberty in
 ‘ the supernatant Liquor, to be turned upon the
 ‘ Winch, and kept out with the staves: This weed is
 ‘ much cultivated in *Kent*, for the use of the *Lon-*
 ‘ *don* Dyers; it holdeth sufficiently well but against
 ‘ Urine and *Tartarous* Liquors. Painters Pinke is
 ‘ made of it.

‘ *Wood-wax*, or *Genista Tinctoria* (commonly cal-
 ‘ led Grasing-weed by the Dyers) produces the same
 ‘ effect with the *Luteola*, being used in greater quan-
 ‘ tities: It is seldom made use of as to Silk, Linnen,
 ‘ or Cottons, but only as to coarse Cloths: It is also
 ‘ set with Pot-ashes or Urine, called by the Dyers
 ‘ *Sigge-fustick*; of it there be two sorts, the *young* and
 ‘ the *old*. *Fustick* is chopt and ground as the other
 ‘ Woods above-mentioned are.

‘ The *young Fustick* dyeth a kind of Reddish
 ‘ Orange-colour; the *old*, a Hair-colour with several

degrees of yellowness between: It is used with slacked Lime. The colours dyed with *old Fustick* hold extreamly, and are not to be discharged, will spend *with* Salts or *without*, and will work hot or cold.

Soot of Wood. *Soot* containeth in it self both a Colour and Salt; wherefore there is nothing added to it to extract its Colour, nor to make it strike upon the Stuff to be Dyed; the natural Colour which it Dyeth of it itself, is the Colour of Honey; but is the foundation of many other Colours upon Wool and Cloth; for to other things it is not used. *Woad* is made of a Weed, sown upon strong new-broken Land, perfectly cleared from all stones and weeds, cut several times by the top leaves, then ground; or rather chopt with a peculiar Mill for that purpose; which being done several times, it is made up in Balls and dried in the Sun; the dryer the year is, the better the *Woad*.

When it is made up in Balls, it is broken again and laid in heaps, where if it heat too fast, it is sprinkled with ordinary water; but if it heat too slowly, then they throw on it a quantity of Lime or Urine. But of the perfect cultivating and curing of *Woad*, we shall speak elsewhere.

English Woad is counted the strongest, it is commonly tryed by staining of white Paper with it, or a white limed Wall, and if the Colour be a French-green it is good.

Woad in use is used with Pot-ashes commonly called Ware, which if it double refin'd, is called hard Ware. (which is much the same with Kelp) or Sea-weeds, calcin'd and burnt into the hardness of a stone, by reiterated Calcinations.

Lime

‘ *Lime* or *Calke*, which is strong *Lime*, is used to
 ‘ accelerate the fermentation of the *Woad*, which by
 ‘ the help of the same Pot-ashes and warm liquors
 ‘ kept always so, in three or four Days will come to
 ‘ work like a Kive of Beer, and will have a blue or
 ‘ rather greenish froth or flowry upon it, answering to
 ‘ the Yest or the Kive. Now the over quantity of
 ‘ Ware, fretting too much upon the *Woad*, is obtund-
 ‘ ed or dilled by throwing in Bran sometimes loose,
 ‘ sometimes in Bags.

‘ The making and using *Woad*, is one of the most
 ‘ mysterious, nice, and hazardous operations in Dy-
 ‘ ing: It is one of the most lasting colours that is
 ‘ dyed: An intense *Woad* Colour is almost black,
 ‘ that is to say, of a Damson colour; this Colour is
 ‘ the foundation of so many others in its degree, that
 ‘ the Dyers have a certain Scale, or number of Stalls,
 ‘ whereby to compute the lightness and deepness of
 ‘ this Colour.

‘ *Indico* is made of a Weed of the same Nature
 ‘ with *Woad*, but more strong; and whereas *Woad*
 ‘ is the whole substance of the Herb, *Indico* is only
 ‘ a mealy concrete juice or *fecula* dried in the Sun,
 ‘ sometimes made up in flat Cakes, sometimes into
 ‘ round Balls; there be several sorts of *Indico*.

‘ *Logwood* is chopt and ground like other of the
 ‘ Woods above-mentioned; it maketh a purplish blue;
 ‘ may be used without Allum: It hath been esteemed
 ‘ a most false and fading colour; but now being used
 ‘ with Galls, is far less complained of.

General

General Observations upon

D Y E I N G.

FIRST, that all the materials (which of themselves do give Colour) are either Red, Yellow, or Blue, so that out of them, and the primitive fundamental Colour White, all that great variety which we see in dyed Stuffs doth arise.

2. That few of the Colouring materials (as Cochineil, Soot, Wood-wax, Woad) are in their outward and first appearance of the same Colour, which by the slightest distempers and solutions in the weakest *Menstrua*, the Dye upon Cloth, Silk, &c.

3. That many of the Colouring materials will not yield their Colours without much grinding, steeping, boyling, fermenting, or corrosion by powerful *Menstrua*; as Red-wood, Weld, Woad, Arnotto, &c.

4. That many of the said Colouring materials will of themselves give no Colouring at all, as Copperas, or Galls, or with much disadvantage, unless the Cloth or other Stuff to be dyed, be as it were first covered or incrustated with some other matter, though Colour-less aforehand, as Mather, Weld, Brasil, with Allum.

5. That some of the said Colouring materials by the help of other colour-less ingredients, do strike different Colours from what they would alone, and of themselves; as Cochineil, Brasil, &c.

6. That

6. That some Colours, as Mather, Indico, and Woad, by reiterated tinctures, will at last become black.

7. That although Green be the most frequent and common of natural Colours, yet there is no simple ingredient, which is now used alone, to dye Green with upon any Material; *Sap-green* (being the condensed juice of the *Rhamnus Berry*) being the nearest; the which is used by Country People.

8. There is no black thing in use which dyes black, tho' both the Coal and Soot of most things burnt or scorched be of that colour; and the blacker, by how much the matter before it was burnt was whiter, as in the famous instance of *Ivory* black.

9. The tincture of some Dying Stuffs will fade even with lying; or with the Air, or will stain even with Water; but very much with Wine, Vinegar, Urine, &c.

10. Some of the Dyers Materials are used to bind and strengthen a Colour, some to brighten it, some to give lustre to the Stuff, some to discharge and take off the Colour either in whole or in part, and some out of fraud, to make the Material dyed (if costly) to be heavier.

11. That some Dying Ingredients or Drugs, by the coarseness of their Bodies, make the thread of the dyed Stuff seem coarser; and some by shrinking them, smaller, and some by levigating their Asperities, finer.

12. Many of the same Colours are dyed upon several Stuffs with several Materials; as *Red-wood* is used in Cloth, not in Silks; *Arnotto* in Silks, not in Cloth; and may be dyed at several prices.

13. That

13. That Scowering and Washing of Stuffs to be dyed, is to be done with special Materials; as sometimes with Ox-galls, sometimes with Fullers-earth, sometimes with Soap: This latter being pernicious in some cases, where Pot-ashes will stain or alter the colour.

14. Where great quantities of Stuffs are to be dyed together, or where they are to be done with great speed, and where the pieces are very long, broad, thick, or otherwise, they are to be differently handled, both in respect to the Vessels and Ingredients.

15. In some Colours and Stuffs the tingent Liquor must be boiling; in other cases blood-warm; in some it may be cold.

16. Some tingent Liquors are fitted for use by long keeping; and in some the vertue wears away by the same.

17. Some Colours or Stuffs are best dyed by reiterated Dippings ever into the same Liquor at several distances of time; and some by continuing longer, and others lesser whiles therein.

18. In some cases the matter of the Vessel wherein the Liquors are heated, and the Tinctures prepared, must be regarded; as the Kettles must be Pewter for Bow-dye.

19. There is little reckoning made how much Liquor is used in proportion to the dying Drugs; the Liquor being rather adjusted to the bulk of the Stuff, as the Vessels are to the breadth of the same: The quantity of dying Drugs being proportioned to the Colour higher or lower, and to the Stuffs both; as likewise the Salts are to dying Drugs.

‘ Concerning the weight which Colours give to
 ‘ Silk (for in them ’tis most taken notice of, as being
 ‘ sold by weight, and being a Commodity of great
 ‘ price) it is observed, That one pound of raw Silk
 ‘ loseth four ounces by washing out the Gums and
 ‘ natural *Sordes*.

‘ That the same scowred Silk may be raised to
 ‘ above thirty ounces from the remaining twelve, if
 ‘ it be dyed black with some Materials.

‘ The reason why Black colour may be most heavy
 ‘ dyed, being because all gravitating Drugs may be
 ‘ dyed black, being all of colours lighter than it :
 ‘ whereas perhaps there are few or no Materials where-
 ‘ with to increase the weight of Silk, which will con-
 ‘ sist with fair light colours ; such as will, having been
 ‘ used, as white Arsenick to Incarnadives. Of a thing
 ‘ truly useful in Dying, especially of Blacks, nothing
 ‘ increases weight so much as Galls, by reason where-
 ‘ of black Silks are restored to as much weight as they
 ‘ lost by washing out their Gum : Nor is it counted ex-
 ‘ traordinary, that Blacks should gain about four or
 ‘ six ounces in the Dying upon each pound.

‘ Next to Galls, old Fustick increases the weight
 ‘ about $1\frac{1}{2}$ in 12.

‘ Mather about one ounce.

‘ Weld half an ounce.

‘ The Blue-far, in deep Blues of the fifth stall,
 ‘ gives no considerable weight.

‘ Neither doth Logwood, Cochineil, nor Arnotto :
 ‘ Nor doth Copperas itself, where Galls are not.

‘ I conceive much light would be given to the
 ‘ Philosophy of Dying, by careful Experiments of the
 ‘ weight added by each Drug or Salt in Dying of every
 ‘ colour.

Slipp adds much to the weight, and giveth a deeper Black than *Copperas* itself; which is a good excuse for the Dyers that use it.

I have hitherto but mentioned the several Colours used in Humane Affairs, enumerated the several Materials used in one of them, namely, Dying; and imperfectly described the several uses and applications of them in Dying. I have also set down some general Observations relating to that whole Trade. It remains now that we describe the several Vessels, Tools, and Utensils used in the same: And particularly to shew how any Colour assigned may be superinduced upon any kind of Material, as Wool, Linnen, Hair, Feathers, Cotton or Silk: And with what Advantages or Disadvantages of Lasting, Brightness, Cheapness, and Variety, &c. each may be performed. But this being infinite, and almost unteachable by words, as being incomparably more difficult, than how to imitate and compose any Colour assigned, out of the few, usually furnishing a Painter's Palat; I leave the whole to the further consideration of this Learned Society.



T H E

HISTORY

Of the Generation and Ordering of

GREEN OYSTERS,

Commonly called

Colchester Oysters.

IN the Month of *May* the *Oysters* cast their Spawn (which the Dredgers call their Spat); it is like to a drop of Candle, and about the bigness of an half-penny.

The Spat cleaves to Stones, old Oyster-shells, pieces of Wood, and such like things, at the bottom of the Sea, which they call Cultch.

'Tis probably conjectur'd, that the Spat in twenty four hours begins to have a Shell.

In the Month of *May* the Dredgers (by the Law of the Admiralty Court) have liberty to catch all manner of *Oysters*, of what size soever.

When they have taken them, with a knife they gently raise the small brood from the Cultch, and then they throw the Cultch in again, to preserve the ground for the future, unless they be so newly Spat that they cannot be safely severed from the Cultch; in that case they are permitted to take the stone or shell, &c. that the Spat is upon, one shell having many times twenty Spats.

‘ After the Month of *May* it is Felony to carry away the Cultch, and punishable to take any other *Oysters*, unless it be those of size (that is to say) about the bigness of an half Crown piece, or when the two shells being shut, a fair shilling will rattle between them.

‘ The places where these *Oysters* are chiefly catch’d, are called the *Pont-Burnham*, *Malden*, and *Colne-Waters*; the latter taking its name from the River of *Colne*, which passeth by *Colne-Chester*, gives the name to that Town, and runs into a Creek of the Sea at a place called the *Hythe*, being the Suburbs of the Town.

‘ This Brood, and other *Oysters*, they carry to Creeks of the Sea at *Brickel-Sea*, *Mersey*, *Langno*, *Fringrego*, *Wivenho*, *Tolesbury*, and *Salt-coase*, and there throw them into the Channel, which they call their Beds or Layers, where they grow and fatten, and in two or three years the smallest Brood will be *Oysters* of the size aforesaid.

‘ Those *Oysters* which they would have green, they put into Pits about three foot deep, in the Salt-Marshes, which are overflowed only at Spring-tides, to which they have Sluices, and let out the Salt-water until it is about a foot and half deep.

‘ These Pits from some quality in the Soil co-operating with the heat of the Sun, will become green, and communicate their colour to the *Oysters* that are put into them in four or five days, though they commonly let them continue there six Weeks, or two Months, in which time they will be of a dark green.

‘ To prove that the Sun operates in the greening, *Tolesbury* Pits will green only in Summer; but that the

the Earth hath the greater power, *Brickel-Sea* Pits green both Winter and Summer: and for a further proof, a Pit within a foot of a greening Pit will not green; and those that did green very well, will in time lose their quality.

The *Oysters* when the Tide comes in, lie with their hollow shell downwards, and when it goes out they turn on the other side; they remove not from their place unless in cold weather, to cover themselves in the Ouse.

The reason of the scarcity of *Oysters*, and consequently of their dearness, is, because they are of late years bought up by the *Dutch*.

There are great penalties by the Admiralty-Court, laid upon those that fish out of those grounds which the Court appoints, or that destroy the Cultch, or that take any *Oysters* that are not of size, or that do not tread under their feet, or throw upon the shore, a Fish which they call a *Five-finger*, resembling a Spur-rowel, because that fish gets into the *Oysters* when they gape, and sucks them out.

The reason why such a penalty is set upon any that shall destroy the Cultch, is because they find that if that be taken away, the Ouse will increase, and then *Muscles* and *Cockles* will breed there, and destroy the *Oysters*, they having not whereon to stick their Spat.

The *Oysters* are sick after they have Spat; but in *June* and *July* they begin to mend, and in *August* they are perfectly well: The *Male-Oyster* is black-sick, having a black Substance in the Fin; the *Female* white-sick (as they term it) having a milky Substance in the Fin. They are salt in the Pits, saltier in the Layers, but saltest at Sea.

In

In composing *Histories* after this manner, they resolve to proceed, till they have not only obtain'd an *Account* of all the great and most substantial *Trades*, but also of all the less *Works*, and Private *Productions*, which are confin'd to some particular *Soyls*, or *Corporations*, or *Families*. As this Stock shall increase, they purpose to make it of General use, either by continuing *Printing* the most remarkable of them, or by freely exposing them to the view of all, that desire such *Informations*; provided, that at the same time they receive some, they will also communicate others: And they have assured grounds of *confidence*, that when this attempt shall be compleated, it will be found to bring innumerable benefits to all practical *Arts*: When all the secrets of *Manufactures* shall be discover'd, their *Materials* describ'd, their *Instruments* figur'd, their *Products* represented: It will soon be determin'd, how far they themselves may be promoted, and what new consequences may thence be deduc'd. Hereby we shall see whether all the parts of the most obvious *Crafts* have been brought to perfection; and whether they may not assist each other, more than has been hitherto endeavour'd: Hereby we shall discern the compass, the power, the changes, the degrees, the ages of them all; and speedily understand, whether their effects have been large enough, and the ways of producing them sufficiently compendious. In short, by this help the worst *Artificers* will be well instructed, by considering the *Methods*, and *Tools* of the best: And the greatest *Inventors* will be exceedingly enlighten'd; because they will have in their view the labours of many men, many places, and many times, wherewith to compare their own. This is the surest, and
most

most effectual means, to enlarge the *Inventions*: whose Nature is such, that it is apt to increase, not only by mens beholding the *Works* of greater, but of equal, nay of less Wits than themselves.

In the whole progress of this *Narration*, I have been cautious to forbear commending the labours of any Private *Fellows* of the *Society*. For this, I need not make any *Apology* to them; seeing it would have been an inconsiderable Honour, to be prais'd by so mean a Writer: But now I must break this *Law*, in the particular case of Dr. *Christopher Wren*: For doing so, I will not alledge the excuse of my *Friendship* to him; though *that* perhaps were sufficient; and it might well be allow'd me to take this occasion of Publishing it: But I only do it on the meer consideration of Justice: For in turning over the *Registers* of the *Society*, I perceived that many excellent things, whose first *Invention* ought to be ascrib'd to him, were casually omitted: This moves me to do him right by himself, and to give this separate Account of his indeavours, in promoting the Design of the *Royal Society*, in the small time wherein he has had the opportunity of attending it.

Sect. XL.
The Conclusion of this Part.

The first instance I shall mention, to which he may lay peculiar claim, is the *Doctrine of Motion*, which is the most considerable of all others, for establishing the first *Principles* of *Philosophy*, by *Geometrical Demonstrations*. This *Des Cartes* had before begun, having taken up some *Experiments* of this kind upon Conjecture, and made them the first *Foundation* of his whole *System* of *Nature*: But some of his Conclusions seeming very questionable, because they were only deriv'd from the gross Trials of Balls meeting

meeting one another at *Tennis*, and *Billiards*: Dr. *Wren* produc'd before the *Society*, an *Instrument* to represent the effects of all sorts of *Impulses*, made between two hard globous Bodies, either of equal, or of different bigness, and swiftness, following or meeting each other, or the one moving, the other at rest. From these varieties arose many unexpected effects; of all which he demonstrated the true *Theories*, after they had been confirm'd by many hundreds of *Experiments* in that *Instrument*. These he propos'd as the Principles of all *Demonstrations* in *Natural Philosophy*: Nor can it seem strange, that these *Elements* should be of such Universal use; if we consider that *Generation*, *Corruption*, *Alteration*, and all the Vicissitudes of *Nature*, are nothing else but the effects arising from the meeting of little Bodies, of differing Figures, Magnitudes, and Velocities.

The Second *Work* which he has advanc'd, is the *History of Seasons*: which will be of admirable benefit to Mankind, if it shall be constantly pursu'd, and deriv'd down to Posterity. His proposal therefore was, to comprehend a *Diary* of Wind, Weather, and other conditions of the *Air*, as to Heat, Cold, and Weight; and also a *General Description* of the Year, whether contagious or healthful to Men or Beasts; with an Account of *Epidemical Diseases*, of Blasts, Mill-dews, and other accidents, belonging to Grain, Cattle, Fish, Fowl, and Insects. And because the difficulty of a constant *Observation* of the *Air*, by Night and Day, seem'd invincible, he therefore devis'd a *Clock* to be annex'd to a Weather-Cock, which mov'd a Rundle cover'd with Paper, upon which the Clock mov'd a Black-lead-Pencil; so that the Observer by the Traces of the Pencil on the

the Paper, might certainly conclude, what Winds had blown in his absence, for twelve hours space: After a like manner he contriv'd a *Thermometer* to be its own *Register*: And because the usual *Thermometers* were not found to give a true measure of the extension of the *Air*, by reason that the accidental gravity of the liquor, as it lay higher or lower in the Glass, weigh unequally on the *Air*, and gave it a farther contraction or extension, over and above that which was produc'd by heat and cold; therefore he invented a *Circular Thermometer*, in which the liquor occasions no fallacy, but remains always in one height moving the whole *Instrument*, like a Wheel on its *Axis*.

He has contriv'd an *Instrument* to measure the quantities of *Rain* that falls: This as soon as it is full, will pour out itself, and at the year's end discover how much Rain has fallen on such a space of Land, or other hard superficies, in order to the *Theory of Vapours, Rivers, Seas, &c.*

He has devis'd many subtil ways for the easier finding the gravity of the *Atmosphere*, the degrees of drought and moisture, and many of its other accidents. Amongst these *Instruments* there are *Balances* which are useful to other purposes, that shew the weight of the *Air* by their spontaneous inclination.

Amongst the new Discoveris of the *Pendulum*, these are to be attributed to him, that the *Pendulum* in its motion from rest to rest; that is, in one descent and ascent, moves unequally in equal times, according to a line of sines: That it would continue to move either in *Circular*, or *Elliptical* Motions; and such *Vibrations* would have the same Periods with those that are reciprocal; and that by a complication

of several *Pendulums* depending one upon another, there might be represented motions like the planetary *Helical Motions*, or more intricate: And yet that these *Pendulums* would discover without confusion (as the *Planets* do) three or four several *Motions*, acting upon one Body with differing *Periods*; and that there may be produc'd a Natural standard for Measure from the *Pendulum* for vulgar use,

He has invented many ways to make *Astronomical Observations* more accurate and easy: *He* has fitted and hung *Quadrants*, *Sextants*, and *Radii*, more commodiously than formerly: *He* has made two *Telescopes*, to open with a joynt like a Sector, by which Observers may infallibly take a distance to half minutes, and find no difference in the same Observation reiterated several times; nor can any warping or luxation of the Instrument hinder the truth of it.

He has added many sorts of *Retes*, *Screws*, and other devises to *Telescopes*, for taking small distances and apparent Diameters to Seconds. *He* has made apertures to take in more or less light, as the Observer pleases, by opening and shutting like the Pupil of the Eye, the better to fit Glasses to *Crepusculine Observations*: *He* has added much to the Theory of *Dioptrics*; much to the Manufacture it self of grinding good Glasses. *He* has attempted, and not without success, the making of Glasses of other forms than Spherical: *He* has exactly measured and delineated the Spheres of the Humours in the Eye, whose proportions one to another were only guess'd at before. This accurate discussion produc'd the Reason, why we see things erected, and that *Reflection* conduces as much to *Vision* as *Refraction*.

He discours'd to them a natural and easy *Theory* of *Refraction*, which exactly answer'd every *Experiment*. *He* fully demonstrat'd all *Dioptrics* in a few Propositions, shewing not only (as in *Kepler's Dioptrics*) the common Properties of Glasses, but the Proportions by which the individual Rays cut the *Axis*, and each other; upon which the Charges (as they are usually called) of *Telescopes*, or the Proportion of the Eyeglasses and *Apertures* are demonstrably discover'd.

He has made constant Observations on *Saturn*; and a *Theory* of that *Planet*, truly answering all *Observations*, before the printed Discourse of *Hugonius* on that Subject appear'd.

He has essay'd to make a true *Selenography* by measure; the *World* having nothing yet but Pictures, rather than Surveys and Maps of the *Moon*. *He* has stat'd the *Theory* of the Moon's Libration, as far as his *Observations* could carry him. *He* has compos'd a *Lunar Globe*, representing not only the Spots, and various degrees of whiteness upon the Surface, but the Hills, Eminencies, and Cavities moulded in solid Work. The Globe thus fashioned into a true Model of the Moon, as you turn it to the Light, represents all the Menstrual phases, with the variety of Appearances that happen from the Shadows of the Mountains and Valleys. *He* has made Maps of the *Pleiades*, and other *Telescopical* Stars; and propos'd Methods to determine the great doubt of the Earth's motion or rest, by the small Stars about the Pole to be seen in large *Telescopes*.

In order to *Navigation* *he* has carefully pursu'd many *Magnetical Experiments*; of which this is one of the noblest and most fruitful *Speculation*: A large *Terrella* is plac'd in the midst of a Plane Board, with a hole

into which the *Terella* is half immers'd, till it be like a *Globe*, with the *Poles* in the *Horizon*. Then is the Plane dusted over with steel-filings equally from a Sieve: The Dust by the *Magnetical* virtue is immediately figur'd into Furrows that bend like a sort of *Helix*, proceeding as it were out of one *Pole*, and returning into the other: And the whole Plane is thus figur'd like the Circles of a *Planisphere*.

It being a Question amongst the Problems of *Navigation*, very well worth resolving, to what Mechanical powers the Sailing (against the wind especially) was reducible; he shew'd it to be a Wedge: And he demonstrated how a transient Force upon an oblique Plane, would cause the motion of the Plane against the first Mover. And he made an *Instrument*, that *Mechanically* produc'd the same effect, and shew'd the reason of Sailing to all Winds.

The *Geometrical Mechanics* of *Rowing*, he shew'd to be a *Vectis* on a moving or cedent *Fulcrum*. For this end he made *Instruments*, to find what the expansion of Body was towards the hindrance of Motion in a Liquid *Medium*; and what degree of impediment was produc'd, by what degree of expansion: With other things that are the necessary Elements for laying down the *Geometry* of *Sailing*, *Swimming*, *Rowing*, *Flying*, and the Fabricks of *Ships*.

He has invented a very curious and exceeding speedy way of *Etching*. He has started several things towards the emendation of *Water-works*. He has made *Instruments* of *Respiration*, and for straining the breath from fuliginous vapours, to try whether the same breath so purify'd will serve again.

He was the first *Inventer* of drawing Pictures by *Microscopical Glasses*. He has found out perpetual, at least

least long-liv'd Lamps, and Registers of Furnaces, and the like, for keeping a perpetual Temper, in order to various uses; as hatching of Eggs, Insects, production of Plants, Chymical Preparations, imitating Nature in producing Fossils and Minerals, keeping the Motion of Watches equal, in order to *Longitudes* and *Astronomical uses*, and infinite other advantages.

He was the first Author of the Noble *Anatomical Experiment of Injecting Liquors into the Veins of Animals*: An *Experiment* now vulgarly known; but long since exhibited to the Meetings at *Oxford*, and thence carried by some *Germans*, and publish'd abroad. By this *Operation* divers Creatures were immediately purg'd, vomited, intoxicated, kill'd, or reviv'd, according to the quality of the Liquor injected. Hence arose many new *Experiments*, and chiefly that of *Transfusing Blood*, which the *Society* has prosecuted in sundry Instances, that will probably end in extraordinary Success.

This is a short account of the principal *Discoveries* which Dr. *Wren* has presented or suggested to this *Assembly*. I know very well, that some of them he did only start and design; and that they have been since carry'd on to perfection, by the industry of other hands. I purpose not to rob them of their share in the honour: Yet it is reasonable, that the original *Invention* should be ascrib'd to the true *Author*, rather than the *Finishers*. Nor do I fear that this will be thought too much, which I have said concerning him: For there is a peculiar reverence due to so much excellence, cover'd with so much modesty. And it is not Flattery but Honesty, to give him his just praise; who is so far from usurping the fame of other men,
that

that he endeavours with all care to conceal his own.

I have now performed my *Promise*, and drawn out of the Papers of the *Society*, an *Epitome* of the chief *Works* they have conceiv'd in their Minds, or reduc'd into Practice. If any shall yet think they have not usefully employ'd their time, I shall be apt to suspect, that they understand not what is meant by a *diligent* and *profitable labouring* about *Nature*. There are indeed some men who will still condemn them for being idle, unless they immediately profess to have found out the Squaring the Circle, or the *Philosophers Stone*, or some other such mighty *Nothings*. But if these are not satisfied with what the *Society* has done, they are only to blame the extravagance of their own Expectations. I confess, I cannot boast of such pompous *Discoveries*: They promise no Wonders, nor endeavour after them: Their Progress has been equal, and firm, by natural degrees, and thorough small things, as well as great: They go leisurably on; but their slowness is not caus'd by their idleness, but care. They have contriv'd in their thoughts, and courageously begun an *Attempt*, which all *Ages* had despair'd of. It is therefore fit that they alone, and not others, who refuse to partake of their burden, should be Judges by what steps, and what pace, they ought to proceed.

Such men are then to be intreated not to interrupt their *Labours* with impertinent rebukes; they are to remember, that the *Subject* of their *Studies* is as large as the *Universe*: and that in so vast an *Enterprise*, many intervals and disappointments must be reckon'd upon. Though they do not behold that the *Society* has already fill'd the world with *perfect Sciences*;

yet

yet they are to be inform'd, that the nature of their *Work* requir'd that they should first begin with *immethodical Collections* and *indigested Experiments*, before they go on to finish and compose them into *Arts*. In which Method they may well be justified, seeing they have the *Almighty Creator* himself for an *Example*: For he at first produc'd a confus'd and scatter'd Light; and reserv'd it to be the *Work* of another day, to gather and fashion it into beautiful *Bodies*,

The End of the Second Part.



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CHICAGO, ILLINOIS

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T H E H I S T O R Y O F T H E R O Y A L S O C I E T Y.

The THIRD PART.



HOUGH it be certain, that the promoting of *Experiments* according to this *Idea*, cannot injure the Virtue, or Wisdom of men's minds, or their former *Arts*, and mechanical Practices, or their establish'd ways of life; yet the perfect innocence of this design, has not been able to free it from the cavil of the *Idle*, and the *Malicious*; nor from the jealousies of private Interests. These groundless prejudices of the particular *Professions*, and *Ranks* of Men, I am now in the last Place to remove; and to shew that there is no Foundation for them: To suspect the *Change*, which can be made by this *Institution*, or the new things it is likely to produce.

Sect. I.
*The Subject
and Division
of this Third
Part.*

That it will probably be the Original of many *new things*, I am so far from denying, that I cheerfully acknowledge it. Nor am I frighted at that, which is wont to be objected in this Case, the hazard of *Alteration*, and *Novelty*. For if all things that are

new be *destructive*, all the several means, and degrees, by which Mankind has risen to this perfection of *Arts*, were to be condemn'd. If to be the *Author* of *new things*, be a crime; how will the first Civilizers of *Men*, and Makers of *Laws*, and Founders of *Governments* escape? Whatever now delights us in the Works of *Nature*, that excels the rudeness of the first Creation, is *New*. Whatever we see in Cities, or Houses, above the first wildness of Fields, and meanness of Cottages, and nakedness of Men, had its time, when this imputation of *Novelty* might as well have been laid to its charge. It is not therefore an offence, to profess the introduction of *New things*, unless that which is introduc'd prove pernicious in itself; or cannot be brought in, without the extirpation of others, that are better.

And the *Experimental Knowledge*, will not expose us to these dangers, I am next to declare, in a universal *Apology* for its intentions, and effects. This was the Third Portion, which I at first reserv'd, for the Conclusion of my Discourse. Yet casting my eyes back, I find, that I have already on several occasions prevented myself; and said many things as I came along, which would have been more proper for this place. But I desire that my Reader would interpret this to have proceeded from the Nature of my Subject, of which it is hard to write a plain *History*, without falling sometimes unawares into its *Praise*. And now I will proceed to a fuller, and more solemn *Defence*: [In which, I will try to prove, that the increase of *Experiments* will be so far from hurting, that it will be many ways advantageous, above other *Studies*, to the wonted Courses of *Education*; to the Principles, and Instruction of the minds of

Men in general; to the *Christian Religion*; to the Church of *England*; to all Manual *Trades*; to *Physic*; to the *Nobility*, and *Gentry*; and the universal Interest of the whole *Kingdom*. ✓

In all which *Particulars*, I hope I shall represent this *Model* to be inoffensive to all the various ways of living, already in use: And thereby I shall secure all the ancient *Proprietors* in their *Rights*: A work as necessary to be done, in raising a new *Philosophy*, as we see it is in building a *new London*.

The first Prejudice I am to wipe away, concerns the usual ways of *Education*. For it is an obvious doubt, whether so great a change in *Works*, and *Opinions*, may not have some fatal consequence, on all the former Methods of *Teaching*, which have been long settled, and approv'd by much Custom. And here many good Men of severe, and ancient manners, may seem to have reason, when they urge against us; that the Courses of Training up of Youth, ought to be still the same; that if they be subverted, or multiply'd, much confusion will follow; and that this our *universal Inquiry* into things hitherto unquestion'd, can never be made, without disturbing such establish'd *Rules of Discipline*, and *Instruction*. Sect. II. *Experiments will not injure Education.*

For a *General Answer* to this, it might suffice to declare, that in this *Institution*, Men are not engag'd in these *Studies*, till the Course of *Education* be fully compleated: That the *Art* of *Experiments* is not thrust into the hands of Boys, or set up to be perform'd by Beginners in the School; but in an Assembly of Men of Ripe years: Who while they begin a *new Method* of Knowledge, which shall consist of *Works*, and is therefore most proper for Men:

They still leave to Learners, and Children, the old talkative *Arts* which best fit the younger Age. From hence it must follow, that all the various manners of *Education*, will remain undisturb'd; because the practices of them, and the labours of this, are not appointed to meet in the same *Age*, or *Persons*. But if this will not satisfy our *Adversaries*, let us proceed to consider the different Parts of *Education*: and then we shall be able to make the surer Conjectures, what manner of Influence *new Experiments* will have upon it.

Education consists in divers Rules, and Practices, whereby men are furnish'd for all the several Courses of Life, to which they may apply themselves. Of these preparatory *Arts*, some concern the *Body*, some the *Mind*. Those of the *Body* have no relation to my present *Argument*: Of those of the *Mind*, some intend the Purity and Ornament of *Speech*: Some the Knowledge of the Actions of former, and present *Times*: Some the Government and Virtue of our Lives: Some the *Method* of Reasoning: Some the Skill in the motions and measures of the *Heavens*, and the *Earth*, and all this great Frame of *Visible* things.

Grammar,
and Rhetoric.

First then I will make no scruple to acquit *Experimental Philosophy*, from having any ill effects on the usual *Arts*, whereby we are taught the Purity, and Elegance of *Languages*. Whatever Discoveries shall appear to us afresh, out of the hidden things of *Nature*, the same words, and the same ways of Expression will remain. Or if, perhaps, by this means, any change shall be made herein; it can be only for the better; by supplying mens Tongues with very many *new things*, to be nam'd, and adorn'd, and describ'd in their discourse.

Nor

Nor can there be any more jealousy concerning the *Moral*, and *Political* Rules of ordering mens lives: *Moral Philosophy.* But they may still have the same influence, and authority, and may be propos'd to our imitation, by the same precepts and arguments of perswasion.

It is also as manifest, that the *Art* of teaching the *History.* *Actions* of former Ages, can from hence receive no damage, or alteration. This cannot be otherwise; seeing the Subjects of *Natural* and *Civil History* do not cross each other; nor does the *New Philosophy* of Nature, more interfere with the *Histories* of *Men* and *Government*, than the *Old*, of which this doubt was never rais'd.

Thus far then we are secure. These great, and fundamental Parts of *Education*, the Instruments of mens Expressing, and Ruling their own minds, and Searching into the Actions of others, will be unalter'd, whatever new changes of Opinions may arise about *Natural Things*. Let us next go on to consider the *Arts* of *Demonstration*, and *Argumentation*, in which consists one of the most weighty Parts of youthful Studies.

First for all the *Mathematical Sciences*, they will *The Mathematic.* still remain the same, and still continue to be learn'd, and taught, in the same *Systems*, and *Methods* as before. Nothing that can now be discover'd will subvert, but rather confirm what is already well built on those immoveable principles. As they came down to us without detriment, through all the corrupt Times of *Learning*; so they will certainly now continue *uncorrupt*, at this present, when *Learning* is restor'd.

Seeing

Seeing they could not be destroy'd in the *Ignorant Ages*, they will be in no fear, at this time, by this *Institution*, which designs not only to enlarge them, but to promote the same rigid way of *Conclusion*, in all other *Natural things*, which only the *Mathematics* have hitherto maintain'd.

*Metaphysics
and Logic.*

Now then, this whole controversy is reduc'd to the alteration, which the *Logic*, and *Physics* of the Ancients, may receive by this change. As for their *Metaphysics*, they scarce deserve to have a place allow'd them in this consideration.

Nor does that prevail with me, which the Lovers of that *Cloudy Knowledge* are wont to boast, that it is an excellent instrument to refine, and make subtil the minds of men. For there may be a greater Excess in the subtilty of mens wits, than in their thicknes: As we see those threads, which are of too fine a spinning, are found to be more usefess, than those which are home-spun, and gross.

Logic is the *Art of Conceiving, Arguing, and Method*. And notwithstanding all the progress which may happen in *Natural Knowledge*, all the several parts of Reasoning, which it teaches in all manner of business, will continue the same: The operations, and power of the *Mind* will still be the same: They will still be subject to the same errors: They will still use the same degrees of Arguing from particular things, to *Propositions* and *Conclusions*; and therefore they will still require the same means, and exercises for *direction*. It is not the complaint of the promoters of *Experiments*, that men have been wanting to themselves, in regulating, disposing, or judging of their own *thoughts*. Nay, they rather condemn them, for being wholly
im-

employ'd about the *productions* of their own *Minds*, and neglecting all the works of *Nature*, that are without them. It cannot therefore be suspected that these *Inquisitive Men*, should busy themselves about altering the *Art of Discourse*, wherein they judge that mankind has been already rather too curious than negligent.

The last Part that I shall mention, of the *Learning* Natural Philosophy. that is taught, is the *System of Natural Philosophy*. And it is in this alone, that I can allow, there will be any alteration made, by this reformation of *Knowledge*. But yet the change will be so advantageous, that I have no reason to dissemble it. I grant indeed that the greatest part of the former Body of *Physics*, may hereby chance to fall to the ground. But to what sum will the damage amount? What can we lose, but only some few *definitions* and idle *questions*, and empty *disputations*? Of which I may say, as one did of *Metaphors*, *Poterimus vivere sine illis*. Perhaps there will be no more use of Twenty, or Thirty obscure Terms, such as *Matter*, and *Form*, *Privation*, *Entelichia*, and the like. But to supply their want, an infinite variety of *Inventions*, *Motions*, and *Operations*, will succeed in the place of words. The beautiful Bosom of *Nature* will be expos'd to our view: We shall enter into its *Garden*, and taste of its *Fruits*, and satisfy our selves with its *plenty*: Instead of idle talking, and wandering under its fruitless shadows, as the *Peripetetics* did in their first institution, and their Successors have done ever since.

Thus

Sect. III.
Experiments
not dangerous to the
Universities.

Thus far I have briefly examined the influence of *new Experiments*, or all the chief Parts of *Education*. And after all the *Innovation*, of which they can be suspected, we find nothing will be indanger'd, but only the *Physics* of *Antiquity*: wherein we also behold, that many things of greater concernment, will arise, to supply the place of what shall be cut away. By this discourse, I hope, I have said enough, to manifest the innocence of this *Design* in respect of all the present *Schools of Learning*; and especially our own *Universities*. And it was but just, that we should have this *tenderness*, for the interest of those magnificent *Seats of humane Knowledge*, and *divine*, to which the *Natural Philosophy* of our Nation, cannot be injurious without horrible *ingratitude*; seeing in them it has been principally cherish'd, and reviv'd. From hence the greatest part of our *Modern Inventions* have deduc'd their *Original*. It is true, such *Experimental Studies* are largely dispers'd at this time: But they first came forth thence, as the *Colonies* of old did from *Rome*: and therefore as those did, they should rather intend the strength, than the destruction of their *Mother Cities*.

I confess there have not been wanting some forward *Afferters* of *new Philosophy*, who have not us'd any kind of *Moderation* towards them: But have presently concluded, that nothing can be well done in *new Discoveries*, unless all the *ancient Arts* be first rejected, and their Nurseries abolish'd. But the rashness of these mens proceedings, has rather prejudic'd, than advanc'd, what they make shew to promote. They have come as furiously to the purging of *Philosophy*, as our *Modern Zealots* did to the

Refor-

Reformation of Religion. And the one Party is as justly to be condemn'd, as the other. Nothing will suffice either of them, but an utter *Destruction, Root and Branch*, of whatever has the face of *Antiquity*. But as the *Universities* have withstood the fierceness of the one's Zeal without Knowledge; so there is no doubt, but they will also prevail against the Violence of the other's pretences to *Knowledge* without *Prudence*.

But now after I have shewn that all the receiv'd Forms of *Education* will be safe, I shall make no Scruple to add my *Conjecture*, that it could be no hindrance to the *minds* of Men, if besides those courses of Studies which are now follow'd, there were also trial made of some other more practical Ways, to prepare their *Minds* for the World, and the Businesses of human Life. It is not enough to urge against this, that the multiplicity of *Methods* would hinder and confound the Spirits of young Men; for it is apparent that nothing more suppresses the *Genius* of *Learners*, than the *Formality*, and the *Confinement* of the Precepts, by which they are instructed. To this purpose I will venture to propose to the *Consideration* of wise Men, whether this way of *Teaching* by *Practice* and *Experiments*, would not at least be as beneficial, as the other by *Universal Rules*: Whether it were not as profitable to apply the Eyes, and the Hands of Children, to see, and to touch all the several kinds of *sensible Things*, as to oblige them to learn, and remember the difficult *Doctrines* of general *Arts*? In a word, Whether a *Mechanical Education* would not excel the *Methodical*?

Sect. IV.
The Advantage of an
Experimental Education.

This certainly is no new Device: For it was that which *Plato* intended, when he enjoin'd his *Scholars* to begin with *Geometry*; whereby, without question, he design'd, that his *Disciples* should first handle *Material Things*, and grow familiar to visible Objects, before they enter'd on the retir'd *Speculations* of other more abstracted *Sciences*.

According to this Counsel of the *Father of Philosophers*, it would not be amiss, if before young Scholars be far engag'd in the beaten Tracks of the Schools, the Mysteries of *Manual Arts*, the Names of their *Instruments*, the Secrets of their *Operations*, the Effects of Natural Causes, the several kinds of *Beasts*, of *Birds*, of *Fishes*, of *Plants*, of *Stones*, of *Minerals*, of *Earths*, of *Waters*, and all their common Virtues and Qualities, were proposed to be the Subjects of their first Thoughts and Observations. It may be here suggested, That the vast Number of such Particulars will soon overwhelm their tender Minds, before they are well establish'd by Time, and Use. But on the contrary it is evident, that the *Memories* of *Youth* are fitter to retain such sensible Images, than those of a fuller Age. It is *Memory* that has most Vigour in Children, and *Judgment* in Men: Which if rightly consider'd, will confirm what I said, that perhaps we take a preposterous Course in *Education*, by teaching *General Rules*, before *Particular Things*: And that therein we have not a sufficient Regard to the different Advantages of *Youth* and *Manhood*. We load the Minds of Children with Doctrines, and Precepts, to apprehend which they are most unfit, by reason of the weakness of their Understandings; whereas they might with more Profit be exercis'd in the Consideration of *visible and sensible Things*; of whose Impressions they

they are most capable, because of the Strength of their *Memories*, and the Perfection of their *Senses*.

The first Years of Men being thus freed from any Apprehensions of Mischief by new *Experiments*: I will now proceed more boldly to bring them in amidst the Throngs, and Crowds of humane Business; and to declare to all Professions, and practical Lives, that they can receive no ill Impressions from them, but that they will be the most beneficial and proper *Studies*, for their Preparation and Direction. And to this Purpose, I will treat of their usefulness, both in respect of Mens public Practice, and the private Government of their own Minds.

Sect. V.
The Use of Experiments to a practical Life.

As to the first, it has been an old Complaint, that has been long manag'd by Men of Business, against many sorts of *Knowledge*, that our Thoughts are thereby infected with such Conceptions as make them more unfit for Action, than they would have been, if they were wholly left to the force of their own *Nature*. The common Accusations against *Learning* are such as these; That it inclines Men to be unsettled, and *contentious*; That it takes up more of their Time, than Men of Business ought to bestow; That it makes them *Romantic*, and subject to frame more perfect Images of Things, than the Things themselves will bear; That it renders them overweening, unchangeable, and obstinate; That thereby Men become averse from a practical Course, and unable to bear the Difficulties of Action; That it employs them about Things, which are no where in use in the World; and, that it draws them to neglect and condemn their own present Times, by doting on the past. But now I will maintain, that in every one of these Dangers *Experimental Knowledge*

Experiments free from the faults of other sorts of Learning.

ledge is less to be suspected than any other; That in most of them (if not all) it is absolutely innocent; nay, That it contains the best Remedies for the Distempers, which some other sorts of Learning are thought to bring with them.

Sect. VI.
The first
Objection
against
Learning,
That it
makes Men
too Disputa-
tive.

The first *Objection* against *Knowledge*, of which I shall take notice in the active part of Life, is this, That it makes Men too plentiful in their *Thoughts*; too inventive, and cavilling in their *Arguments*; and so rather teaches them to be witty in *Objecting*, than ready in *Resolving*, and diligent in *Performing*. I confess the Ancient *Philosophy* will hardly be able to vindicate it self from this Charge: For its chief Purpose is to enlarge the Fancy, and to fill the Head with the Matter and Artifice of Discourse. But this cannot any way touch the *Art of Experiments*: That consists not in *Topics* of Reasoning, but of Working: That indeed is full of doubting and inquiry, and will scarce be brought to settle its Assent; but it is such a doubting as proceeds on *Trials*, and not on *Arguments*: That does neither practise nor cherish this humour of Disputing, which breaks the force of Things by the subtilty of Words; as *Seneca* was said to do by his Style: It weakens Mens Arms, and slackens all the Sinews of Action: For so it commonly happens, that such earnest Disputers evaporate all the strength of their Minds in arguing, questioning, and debating; and tire themselves out before they come to the *Practice*.

Sect. VII.
The second,
That it takes
up too much
time.

The next Accusation is, That so many intricate Paths, and spacious Windings of *Learning*, will require more time than can be spar'd by Men of active and busy

busy Lives. The Belief of this has always made a wide Divorce between Men of *Knowledge* and *Action*; while both have thought, that they must either be wholly *Scholars*, or wholly Men of *Business*; and that an Excellence in both these Courses, can never be obtain'd by human Wit. 'Tis true indeed, there is no *Knowledge* or *Science* that can be acquitted from being too large, if their *Professors* have not the Discretion to know how far to proceed, and what Moderation is to be us'd in every *Study*. There is in the least *Art* enough Matter, about which if Men shall resolve to trouble their Brains all their Lives, one *Question* and *Difficulty* will perpetually beget another, and so (as one of the *Ancients* says) *Ipse tractatio, & questio quotidie ex se gignet aliquid, quod cum desiderio delectatione vestiges.*

To this Danger perhaps *Experiments* may seem most expos'd, by reason of the infinite multitude of particulars, and innumerable variations of *Inquiries*, that may be made. But the *Royal Society* has prevented this Mischief, by the Number and Succession of those that shall undertake the *Work*. They require not the whole time of any of their *Members*, except only of their *Curators*: From the rest they expect no more but what their *Business*, nay even their very *Recreations* can spare. It is the Continuance and Perpetuity of such *Philosophical Labours*, to which they principally trust; which will both allow a sufficient Relaxation to all the particular *Labourers*, and will also give good assurance of the happy Issue of their *Work* at the last: For though that be true, which the Great Physician laments, *That Art is long, and Life is short*; yet many Lives of studious and industrious Men in one *Age*, and the Succession of many Lives of such Men in all
future

future *Ages*, will undoubtedly prove as long as *Art* itself.

SECT. VIII.
The third
Objection,
That it
makes our
Minds Ro-
mantic.

They farther object against *Learning*, That it makes our Minds too *Lofty* and *Romantic*, and inclines them to form more perfect Imaginations of the Matters we are to practise than the Matters themselves will bear. I cannot deny but a meer contemplative Man is obnoxious to this Error: He converses chiefly in his Closet, with the Heads and Notions of Things, and so discerns not their Bottoms near and distinctly enough: And thence he is subject to overlook the little Circumstances, on which all human Actions depend. He is still reducing all Things to standing *Doctrines*; and therefore must needs be liable to neglect the Opportunities, to set upon Business too soon, or too late; to put those Things together in his Mind, which have no agreement in *Nature*. But this above all is his greatest Danger, that thinking it still becomes him to go out of the *ordinary Way*, and to refine and heighten the Conceptions of the Vulgar, he will be ready to disdain all the *natural* and *easy* ways of *Practice*, and to believe that nothing ought to be done, though never so common, but by some device of *Art*, and trick of unusual *Wisdom*.

From these Inconveniencies the *Experimenter* is secure: He invents not what he does out of himself; but gathers it from the Footsteps and Progress of *Nature*. He looks on every Thing standing equal to it, and not as from a higher Ground: He labours about the plain and undigested Objects of his Senses, without considering them as they are joyn'd into common *Notions*. He has an Opportunity of understanding the most natural Ways by which all Things are produc'd.

duc'd. He clearly beholds all the secret Accidents and Turnings, Advantages and Failings of *Nature*. He endeavours rather to know, than to admire; and looks upon *Admiration*, not as the End, but the Imperfection of our *Knowledge*.

The next hindrance of *Action*, is an *obstinacy of Resolution*, and a want of *Dexterity* to change our apprehensions of Things according to Occasions. This is the more destructive, because it carries with it the most solemn appearance of *Wisdom*. There is scarce any thing that renders a Man so useless, as a *perverse sticking to the same things in all times*, because he has sometimes found them to have been in Season. But now in this, there is scarce any *Comparison* to be made, between him who is only a *thinking Man*, and a *Man of Experience*. The first does commonly establish his constant Rules, by which he will be guided: The latter makes none of his *Opinions* irrevocable. The one, if he mistakes, receives his Errors from his *Understanding*; the other only from his *Senses*; and so he may correct, and alter them with more ease. The one fixes his *Opinion* as soon; the other doubts as long as he can. The one chiefly strives to be unmovable in his Mind; the other to enlarge, and amend his *Knowledge*: And from hence the one is inclin'd to be *presumptuous*, the other modest in his *Judgment*.

Sect. IX.
The fourth
Objection,
That it
makes Men
presumptu-
ous and ob-
stinate.

The next Pretence, on which Men of *Learning* are wont to be vilified, is, that they use to be so much affected with the pleasant Musings of their own Thoughts, as to abhor the Roughness, and Toyl of *Business*. This Accusation, I confess, is not altogether groundless. The solitary Imaginations of *Speculative*

Sect. X.
The fifth Ob-
jection, That
'tis Pleasure
draws Men
off from Bu-
siness.

culative Men are of all other the most easy: There a Man meets with little stubbornness of Matter: He may choose his Subject where he likes; he may fashion and turn it as he pleases: Whereas when he comes abroad into the World, he must endure more *Contradiction*: More *Difficulties* are to be overcome; and he cannot always follow his own *Genius*: So that it is not to be wonder'd, that so many *great Wits* have despis'd the labour of a practical Course; and have rather chosen to shut themselves up from the *Noise* and *Preferments* of the *World*, to converse in the Shadow with the pleasant *Productions* of their own *Fancies*.

And this perhaps is the reason why the most *extraordinary Men of Arts* in all Ages, are generally observ'd to be the greatest *Humourists*: They are so full of the sweetness of their own *Conceptions*, that they become Morose, when they are drawn from them, they cannot easily make their Minds ductil and pliable to others Tempers, and so they appear untractable, and unskilful in *Conversation*.

From this I shall also free the *Experimental Philosopher*. The Satisfaction that he finds, is not *imaginary*, but *real*: It is drawn from Things that are not out of the World, but in it: It does not carry him farther off, but brings him nearer to *Practice*. 'Tis true, that *Knowledge* which is only founded on Thoughts and Words, has seldom any other end, but the breeding and increasing of more Thoughts and Words: But that which is built on Works (as his will be) will naturally desire to discover, to augment, to apply, to communicate it self by more Works.

Nor can it be thought, that his *Mind* will be made to languish by this pleasure of *Observation*, and to have any Aversion from the difficulty and tediousness of
of

of human Affairs; seeing his way of *Observation* it self is so *laborious*. It is a good Precept, which is wont to be given in respect of all sorts of *Exercises*, that they should be at least as hard and toilsome, as that *Art* which we strive to gain by them. And by this Rule *Experiments* are an excellent preparation towards any habit or faculty of Life whatsoever. For what Thing, which can be effected by *mortal Industry*, can seem impossible to him who has been engag'd in these *Studies*, which require such an indefatigable Watchfulness? What can overcome his Diligence, who has been able to sustain with Patience the *Escapes*, the *Delays*, the *Labyrinths* of *Nature*; whom the Repetition of so many *Labours*, so many Failings, with which he meets, and so long attendance could not tire?

ANOTHER principal Mischief to be avoided, is the Conformity of our *Actions* to Times past, and not the present. This Extravagance is generally imputed to *studious* Men; and they cannot be wholly acquitted from it. For while they continue heaping up in their *Memories* the Customs of past *Ages*, they fall insensibly to imitate them, without any manner of Care how suitable they are to *Times* and *Things*. The Grounds of this Mistake will be worth our discovering, because in Mens Opinions it does so much Prejudice to the Learned part of the *World*. In the ancient *Authors* which they turn over, they find Descriptions of *Vertues* more perfect then indeed they were: The *Governments* are represented better, and the Ways of Life pleasanter than they deserv'd. Upon this, these *Bookish* wise Men strait compare what they read with what they see: And here beholding nothing so heroically transcendent, because they are able to mark all

Sect. XI.
The sixth
Objection,
That it
makes Men
regard the
Times past,
and neglect
the present.

the *Spots*, as well as *Beauties* of every Thing, that is so close to their Sight, they presently begin to dispise their own *Times*, to exalt the past, to contemn the *Virtues*, and aggravate the *Vices* of their *Country*; not endeavouring to amend them, but by such Examples as are now unpracticable, by reason of the Alteration of *Men* and *Manners*.

For this Defect, *Experiments* are a soveraign Cure; They give us a perfect Sight of what is before us; they bring us home to our selves; they make us live in *England*, and not in *Athens* or *Sparta*, at this present time, and not three thousand Years ago: Though they permit us to reflect on what has been done in *former Ages*; yet they make us chiefly to regard and contemplate the Things that are in our *View*. This certainly is conformable to the *Design* of *Nature* it self; which though it has fram'd our Bodies in that manner, that we may easily upon occasion turn about to look behind us; yet it has plac'd the *Eyes*, the chief *Instruments* of *Observation*, not in our *Backs*, but in our *Foreheads*.

Sect. XII.
The seventh
Objection,
That it hin-
ders Use.

THE last Failing which is wont to be imputed to *Learned Men*, is want of *Use*, and fear of *Practice*, and a conversing with Things in their *Studies*, which they meet with no where else. It may now perhaps be thought that an *Experimenter* is as inclinable to these Weaknesses, as he that only contemplates; because they both keep out of the way, in the Shadow; the one in his *Library*, arguing, objecting, defending, concluding with himself; the other in his *Workhouse*, with such Tools and Materials, whercof many perhaps are not publickly in use. Let us then consider which of them is most to be blam'd for conversing with Matters unlike

like those that we meet with in *Civil Affairs*? And which most abounds with *Fears* and *Doubts*, and mistaken in Ideas of *Things*.

It cannot be denied, but the Men of *Reading* do very much busy themselves about such *Conceptions*, which are no where to be found out of their own Chambers. The *Sense*, the *Custom*, the *Practice*, the *Judgment* of the World, is quite a different Thing from what they imagine it to be in private. And therefore it is no wonder, if when they come abroad into Business, the sight of Men, the Tumult and Noise of Cities, and the very brightness of Day it self affright them: Like that *Rhetorician*, who having been us'd to declaim in the shade of a *School*, when he came to plead a true Cause in the open *Air*, desir'd the Judges to remove their Seat under some Roof, because the *Light* offended him.

But now on the other side, the Men of *Works* and *Experiments* perhaps do not always handle the very same *Subjects* that are acted on the Stage of the *World*; yet they are such as have a very great resemblance to them. It is *Matter*, a visible and sensible *Matter*, which is the Object of their *Labours*: And the same is also us'd by Men of practical Lives. This Likeness of their *Employments* will soon make the one excel in the other. For it is far easier for him who has been conversant in one sort of *Works*, to apply himself to any other; than for him who has only thought much, to turn a Man of *Practice*: As he that can paint the Face of a Man or a Lion, will much sooner come to draw any other Creature, than he who has all the *Rules* of *Limning* in his Head, but never yet us'd his Hand to lay on a *Colour*.

And as for the *Terrors* and *Misapprehensions* which

commonly confound weaker Minds, and make Mens Hearts to fail and boggle at Trifles; there is so little hope of having them remov'd by *Speculation* alone, that it is evident they were first produc'd by the most *contemplative* Men amongst the *Ancients*; and chiefly prevail'd of late Years, when that way of *Learning* flourish'd. The *Poets* began of old to impose the Deceit. They to make all Things look more venerable than they were, devis'd a thousand false *Chimæras*; on every *Field, River, Grove, and Cave* they bestow'd a *Fantasm* of their own making: With these they amaz'd the World; these they cloath'd with what Shapes they pleas'd; by these they pretended, that all Wars, and Counsels, and Actions of Men were administred. And in the modern *Ages* these *Fantastical Forms* were reviv'd and possess'd *Christendom*, in the very height of the *Schoolmens* time: An infinite Number of *Faries* haunted every House; all Churches were fill'd with *Apparitions*; Men began to be frighted from their *Cradles*, which Fright continu'd to their *Graves*, and their Names also were made the Causes of scaring others. All which Abuses if those acute *Philosophers* did not promote, yet they were never able to overcome; nay, even not so much as King *Oberon* and his invisible *Army*.

But from the time in which the *real Philosophy* has appear'd, there is scarce any whisper remaining of such *Horrors*: Every Man is unshaken at those Tales at which his *Ancestors* trembled: The Course of Things goes quietly along in its own true Channel of *Natural Causes and Effects*. For this we are beholden to *Experiments*; which though they have not yet compleated the Discovery of the true World, yet they have already vanquish'd those wild Inhabitants of the false
Worlds

Worlds, that us'd to astonish the Minds of Men. A Blessing for which we ought to be thankful, if we remember, that it is one of the greatest Curses that God pronounces on the Wicked, *that they shall fear where no fear is.*

From what I have said may be gather'd, That *Experimental Philosophy* will prevent Mens spending the strength of their Thoughts about *Disputes*, by turning them to *Works*: That it may well be attended by the united *Labours* of many, without wholly devouring the time of those that *labour*: That it will cure our Minds of *romantic Swelling*, by shewing all Things familiarly to them, just as large as they are: That it will free them from *Perversity*, by not permitting them to be too peremptory in their *Conclusions*: That it accustoms our Hands to Things which have a near resemblance to the business of Life; and, that it draws away the Shadows which either enlarge or darken *human Affairs*. And indeed of the usual Titles by which Men of Business are wont to be distinguish'd, the *Crafty*, the *Formal*, and the *Prudent*; the *Crafty* may answer to the *Empyric* in *Philosophy*; that is, he is such a one who has a great Collection of particular *Experiences*, but knows not how to use them but to base and low Ends. The *Formal* Man may be compar'd to the meer *Speculative Philosopher*: For he vainly reduces every Thing to grave and solemn general *Rules*, without Discretion, or mature Deliberation. And lastly, the *Prudent* Man is like him who proceeds on a constant and solid course of *Experiments*. The one in Civil Life neither wholly rejects the Wisdom of *Ancient* or *Modern* times: The other in *Philosophy* has the same reverence for *former Ages*, and regard for the *present*. The one does not rest upon
empty:

empty *Prudence*, but designs it for Action: The other does the same with his Discoveries: Upon a just, severe, and deliberate Examination of Things, they both raise their *Observations*, which they do not suffer to lie idle, but use them to direct the *Actions*, and supply the *Wants of human Life*.

Sect. XIII.
Experiments use-
ful for the
cure of Mens
Minds.

BESIDES what I have said of the help which *Experiments* will bring to our public *Duties*, and civil *Actions*, I promis'd to add something concerning the Assistance that they are able to give towards the Management of the private *Motions*, and *Passions* of our *Minds*: Of this I need say the less, because there is amongst the *Philosophers* a particular Science appointed for this Purpose, to prescribe Rules for calming our *Affections*, and conquering our *Vices*. However, I will not wholly pass it over in Silence: but I will try in few Words to make appear, that the *real Philosophy* will supply our Thoughts with excellent *Medicines* against their own *Extravagancies*, and will serve in some sort, for the same ends, which the *Moral* professes to accomplish.

If we shall cast an Eye on all the *Tempests* which arise within our Breasts, and consider the Causes, and Remedies of all the violent *Desires*, malicious *Envies*, intemperate *Jays*, and irregular *Griefs*, by which the Lives of most Men become *miserable*, or *guilty*; we shall find, that they are chiefly produc'd by *Idleness*, and may be most naturally cur'd by *Diversion*. Whatever *Art* shall be able to busy the *Minds* of Men, with a constant course of *innocent Works*, or to fill them with as vigorous and pleasant Images, as those ill *Impressions*, by which they are deluded; it will certainly have a surer effect in the composing and purifying

purifying of their Thoughts, than all the rigid Precepts of the Stoical, or the empty Distinctions of the *Peripatetic Moralists*.

Now then it is requir'd in that *Study*, which shall attempt, according to the force of *Nature*, to cure the Diseases of the Mind, that it keep it from *Idleness*, by full and earnest *Employments*; and that it possess it with innocent, various, lasting, and even sensible *Delights*.

How active and industrious the *Art of Experiments* ought to be, may be concluded from the whole tenour of my Discourse: wherein I have often prov'd, that it can never be finish'd by the perpetual *Labours* of any one Man, nay scarce by the successive force of the greatest *Assembly*.

That therefore being taken for granted, that it will afford eternal *Employments*: It is also as true, that it's Labours will contain the most *affecting*, and the most *diverting Delights*: And that thence it has Power enough to free the *Minds* of Men from their Vanities and Intemperance, by that very way which the greatest *Epicure* has no reason to reject, by opposing Pleasure against Pleasure.

And I dare challenge all the corrupt *Arts* of our *Senses*, or the Devices of voluptuous Wits, to provide fuller, more changable, or nearer Objects, for the Contentment of Mens *Minds*. It were indeed to be wish'd, that severe Virtue itself, attended only by its own *Authority*, were powerful enough to establish its Dominion. But it cannot be so. The Corruptions, and Infirmities of *Human Nature* stand in need of all manner of Allurements, to draw us to Good, and quiet Manners. I will therefore propose for this End this Course of *Study*, which will not affright us
with

with rigid Precepts, or sour Looks, or peevish Commands, but consists of sensible *Pleasure*, and besides will be most lasting in its Satisfaction, and innocent in its Remembrance.

What *Raptures* can the most *voluptuous* Men fancy, to which these are not equal? Can they relish nothing but the *Pleasures* of their *Senses*? They may here enjoy them without Guilt or Remorse. Are they affrighted at the Difficulties of *Knowledge*? Here they may meet with a *Study*, that as well fits the most *negligent* Minds, as the most *industrious*. This consists of so many *Works*, and those so obvious, and facil, that the most laborious will never find Cause to be idle, and the most idle may still have something to do with the greatest ease. In this they need not weary themselves by searching for *Matter*: whatever they feel, or see, will afford them *Observations*. In this there is no tedious Preparation requir'd to fit them for such Endeavours: as soon as they have the use of their *Hands*, and *Eyes*, and common *Sense*, they are sufficiently furnish'd to undertake them. Though we cannot comprehend the *Arts* of Men without many previous *Studies*, yet such is the Indulgence of *Nature*, that it has from the Beginning, out of its own Store, sufficiently provided every Man with all Things, that are needful for the understanding of it self.

Thus neither the *sensual Mind*, has any occasion to contemn *Experiments* as unpleasant, nor the idle as burdensome, or intolerable, nor the virtuous as unworthy of his *Labours*. And the same Influence they may have on all other *moral* Imperfections of *human Nature*. What room can there be for low and little *Things* in a *Mind* so usefully and successfully employ'd?

What

What *ambitious Disquiets* can torment that Man, who has so much Glory before him, for which there are only requir'd the delightful *Works* of his *Hands*? What dark or melancholy *Passions* can overshadow his *Heart*, whose *Senses* are always full of so many various *Productions*, of which the least Progress, and Success, will affect him with an *innocent Joy*? What Anger, Envy, Hatred, or Revenge, can long torment his Breast, whom not only the greatest, and noblest Objects, but every Sand, every Pebble, every Grass, every Earth, every Fly can divert? To whom the return of every Season, every Month, every Day, do suggest a Circle of most pleasant *Operations*? If the *Antients* prescrib'd it as a sufficient *Remedy* against such *violent Passions*, only to repeat the Alphabet over; whereby there was Leisure given to the *Mind*, to recover itself from any sudden Fury: Then how much more *effectual Medicines*, against the same *Distempers*, may be fetch'd from the whole Alphabet of *Nature*, which represents itself to our *Consideration*, in so many infinite *Volumes*!

I will now proceed to the weightiest, and most solemn Part of my whole *Undertaking*; to make a Defence of the *Royal Society*, and this new *Experimental Learning*, in Respect of the *Christian Faith*. I am not ignorant, in what a slippery Place I now stand; and what a tender Matter I am enter'd upon. I know that it is almost impossible without Offence, to speak of things of this *Nature*, in which all *Mankind*, each *Country*, and now almost every *Family*, do so widely disagree among themselves. I cannot expect that what I shall say will escape Misinterpretation, though it be spoken with the greatest Simplicity,

Sect. XIV.
Experiments
not dangerous
to the
Christian
Religion.

plicity, and Submission, while I behold that most Men do rather value themselves, and others, on the little Differences of *Religion*, than the main Substance itself; and while the Will of *God* is so variously distracted, that what appears to be *Piety* to some *Christians*, is abhorr'd as the greatest Superstition and Heresy by others.

However to smooth my Way as much as I can, and to prepare all our several *Spiritual Interests*, to read this Part with some tolerable *Moderation*; I do here, in the beginning, most sincerely declare, that if this Design should in the least diminish the *Reverence* that is due to the *Doctrine of Jesus Christ*, it were so far from deserving *Protection*, that it ought to be abhorr'd by all the *Politick* and *Prudent*, as well as by the devout Part of Christendom. And this, I profess, I think they were bound to do, not only from a just Dread of the *Being*, the *Worship*, the *Omnipotence*, the *Love of God*, all which are to be held in the highest Veneration, but also out of a Regard to the Peace and Prosperity of Men. In Matters that concern our *Opinions* of another *World*, the least Alterations are of wonderful Hazard. How mischievous then would that Enterprize be, whose Effects would abolish the *Command of Conscience*, the Belief of a *Future Life*; or any of those Heavenly *Doctrines*, by which not only the *Eternal Condition* of Men is secur'd, but their *Natural Reason*, and their *Temporal Safety* advanc'd? Whoever shall impiously attempt to subvert the Authority of the *Divine Power*, on false Pretences to better *Knowledge*, he will unsettle the strongest Foundations of our *Hopes*: he will make a terrible Confusion in all the Offices and Opinions of Men: he will destroy the most prevailing *Argument to Virtue*:
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he will remove all *Human Actions*, from their firmest Center: he will even deprive himself of the Prerogative of his *Immortal Soul*; and will have the same Success that the *Ancient Fables* make those to have had, who contended with their *God*, of whom they report, that many were immediately turn'd into *Beasts*.

With these Apprehensions I come to examine the *Objections*, which I am now to satisfy: and having calmly compar'd the *Arguments* of some devout Men against *Knowledge*, and chiefly that of *Experiments*; I must pronounce them both to be altogether inoffensive. I did before affirm, that the *Royal Society* is abundantly cautious, not to intermeddle in *Spiritual Things*: But that being only a general Plea, and the Question not lying so much on what they do at present, as upon the probable Effects of their Enterprize, I will bring it to the Test through the chief Parts of *Christianity*; and shew that it will be found as much averse from *Atheism*, in its Issue and Consequences, as it was in its original Purpose.

The publick Declaration of the *Christian Religion*, is to propose to Mankind an infallible Way to *Salvation*. Towards the Performance of this happy End, besides the *Principles* of *Natural Religion*, which consists in the Acknowledgment and Worship of a *Deity*, it has offer'd us the Merits of a glorious *Saviour*: By him, and his *Apostles Ministry*, it has given us sufficient *Examples*, and *Doctrines*, to acquaint us with *Divine Things*, and carry us to *Heaven*. In every one of these, the *Experiments* of *Natural Things*, do neither darken our Eyes, nor deceive our Minds, nor deprave our Hearts.

Sect. XV.
Experiments
will not de-
stroy the Do-
ctrine of the
Godhead.

First, there can be no just Reason assign'd, why an *Experimenter* should be prone to deny the Essence, and Properties of *God*, the universal Sovereignty of his *Dominion*, and his Providence over the *Creation*. He has before him the very same Argument to confirm his Judgment in all these; with which he himself is wont to be abundantly satisfy'd, when he meets with it in any of his *Philosophical Inquiries*. In every thing that he tries, he believes, that this is enough for him to rest on, if he finds, that not only his own, but the *universal Observations* of Men of all Times and Places, without any mutual Conspiracy, have consented in the same *Conclusion*. How can he then refrain from embracing this common *Truth*, which is witness'd by the unanimous Approbation of all *Countries*, the Agreement of *Nations*, and the secret Acknowledgment of every Man's Breast?

'Tis true, his *Employment* is about *material Things*. But, this is so far from drawing him to oppose invisible *Beings*, that it rather puts his Thoughts into an excellent good Capacity to believe them. In every *Work* of *Nature* that he handles, he knows that there is not only a gross Substance, which presents itself to all Mens Eyes; but an infinite Subtlety of *Parts*, which come not into the sharpest Sense. So that what the *Scripture* relates of the Purity of *God*, of the Spirituality of his *Nature*, and that of *Angels*, and the *Souls* of Men, cannot seem incredible to him, when he perceives the numberless Particles that move in every Man's *Blood*, and the prodigious Streams that continually flow unseen from every *Body*. Having found that his own *Senses* have been so far assist-ed by the *Instruments* of *Art*, he may sooner admit,

mit, that his Mind ought to be rais'd higher, by a heavenly Light, in those things wherein his *Senses* do fall short. If (as the *Apostle* says) the invisible things of *God* are manifested by the visible; then how much stronger Arguments has he for his Belief, in the *eternal Power* and *Godhead*, from the vast Number of Creatures, that are invisible to others, but are expos'd to his View by the help of his *Experiments*?

Thus he is prepar'd to admit a *Deity*, and to embrace the Consequences of that Concession. He is also from his *Experiments* as well furnish'd with *Arguments* to adore it: He has always before his Eyes the *Beauty*, *Contrivance*, and *Order* of *God's Works*: From hence he will learn to serve him with all Reverence, who in all that he has made, consulted *Ornament*, as well as *Use*.

From hence he will best understand the infinite Distance between *himself* and his *Creator*, when he finds that all things were produc'd by him: Whereas he by all his Study, can scarce imitate the least Effects, nor hasten, or retard the common Course of *Nature*. This will teach him to *worship* that *Wisdom*, by which all things are so easily sustain'd, when he has look'd more familiarly into them, and beheld the Chances and Alterations, to which they are expos'd. Hence he will be led to admire the wonderful Contrivance of the *Creation*; and so to apply, and direct his Praises aright; which, no doubt, when they are offer'd up to *Heaven*, from the Mouth of one, who has well studied what he commends, will be more suitable to the *Divine Nature*, than the blind Applauses of the Ignorant. This was the first Service that *Adam* perform'd to his *Creator*, when he obey'd him in mu-

string;

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Experiments
not injurious
to the worship
of God.

string, and naming, and looking into the *Nature* of all the *Creatures*. This had been the only *Religion*, if Man had continued innocent in *Paradise*, and had not wanted a *Redemption*. Of this the *Scripture* itself makes so much Use, that if any devout Man shall reject all *Natural Philosophy*, he may blot *Genesis*, and *Job*, and the *Psalms*, and some other Books out of the *Canon* of the *Bible*. God never yet left himself without Witness in the *World*: And it is observable, that he has commonly chosen the dark and ignorant *Ages*, wherein to work Miracles; but seldom or never the Times when *Natural Knowledge* prevail'd: For he knew there was not so much need to make use of extraordinary Signs, when Men were diligent in the Works of his Hands, and attentive on the Impressions of his Foot-steps in his *Creatures*.

It is almost a *proverbial* Speech, that the most Learned *Ages* are still the most Atheistical, and the Ignorant most Devout. Whoever devis'd this Distinction at first, the true *Piety* is little beholden to him for it; for instead of obeying the *Jewish Law*, which forbids us to offer up to God a Sacrifice that has a Blemish, he has bestow'd the most excellent of all the Race of Men on the Devil; and has only assign'd to *Religion* those *Men* and those *Times*, which have the greatest Blemish of *Human Nature*, even a Defect in their *Knowledge* and *Understanding*.

If there can be found any Colour for this *Observation*, that the *Light* of *Reason* should produce a *Spiritual Darkeness*; it can only then hold good, when the *Knowledge* of Men; and not that of *Nature*, abounds. Whether the first be true, or no, let the *Politicians* consider: But of the second, this is a sufficient Conviction; that in most Countries God has been worshipp'd

shipp'd in a Form proportionable to that kind of *Natural Philosophy* in which they excell'd. In *Persia* where the Skill of the *Heavenly Motions* first began, they had their Temples on the Tops of Hills, and open to the Air. In *Agypt* they had the best Opportunities of studying the Nature of *living Creatures*; by reason of that variety which their River and their Land produc'd. And their *Religious Mysteries* were contain'd in *Hieroglyphicks*, which were most of them borrow'd from Beasts. And why should *Natural Philosophy* be now condemn'd for contempt of all *Divinity*, when of old it did rather incline them to *Superstition*, which is the other extreme? It is true indeed, by that *Knowledge* which they had of many *Creatures*, they were drawn to adore them; but that was only because it was imperfect: If they had understood them thoroughly, they had never done it: So true is that Saying of my Lord *Bacon*, *That by a little Knowledge of Nature Men become Atheists; but a great deal returns them back again to a sound and religious Mind.* In brief, if we rightly apprehend the Matter, it will be found that it is not only *Sottishness*, but *Prophaness*, for Men to cry out against the understanding of *Nature*; for that being nothing else but the Instrument of *God*, whereby he gives Being and Action to *Things*, the *Knowledge* of it deserves so little to be esteem'd impious, that it ought rather to be reckon'd as *Divine*.

But the chief Part of our *Religion*, on which the Certainty of all the rest depends, is the *Evangelical Doctrine of Salvation* by *Jesus Christ*. In this there is nothing from which he that converses much with *Nature*, can be thought to be more averse than others: nay,

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Experiments not prejudicial to the Doctrine of the Gospel.

The HISTORY of

may, to which he may not be concluded to be more inclinable, on this very Account; seeing it has all been prov'd to him his own Way. Had not the appearance of *Christ* been strengthen'd by undeniable Signs of *Almighty Power*, no Age nor Place had been oblig'd to believe his Message. And these *Miracles* with which he asserted the *Truths* that he taught (if I might be allow'd this Boldness in a Matter so sacred) I would even venture to call *Divine Experiments* of his Godhead.

What then can there be in all this *Doctrine*, at which a real and impartial *Inquirer* into *natural Things*, should be offended? Does he demand a Testimony from *Heaven*? He has it: He reads Effects produc'd, that did exceed all mortal Skill and Force: And of this he himself is a better Judge than others: For to understand aright what is *Supernatural*, it is a good Step first to *know* what is according to *Nature*.

Does he require that this should be testified, not by Men of *Craft* or *Speculation*; but rather by Men of *Honesty*, *Trades*, and *Business*? The *Apostles* were such. Will he not consent to any Man's *Opinions*, unless he sees the *Operations* of his Hands agree with them? *Christ* himself requires no more of any of his *Followers*: For he commanded his *Disciples* not to believe him, but the *Works* that he did. Does he think that it is the most honourable Labour to study the Benefit of Mankind? to help their Infirmities? to supply their Wants? to ease their Burdens? He here may behold the whole *Doctrine* of *Future Happiness* introduc'd by the same Means; by feeding the Hungry, by curing the Lame, and by opening the Eyes of the Blind: All which may be call'd *Philosophical Works*, perform'd by an *Almighty Hand*.

What

What then can hinder him from loving and admiring this *Saviour*, whose *Design* is so comfortable to his own, but his *Ability* so much greater? What Jealousy can he have of an Imposture in this *Messias*? Who though his *Doctrine* was so pure and venerable, though his *Life* was so blameless, though he had the Power of *Heaven* and *Earth* in his Hands, though he knew the Thoughts of Men, and might have touch'd and mov'd them as he pleas'd; did yet not rely on his *Doctrine*, on his *Life*, on the irresistible Assistance of *Angels*, or on his own *Divinity* alone; but stoop'd to convince Men by their *Senses*, and by the very same Course by which they receive all their *Natural Knowledge*.

THE last *Doctrinal* Part of our *Religion* I shall mention, consists of those *Doctrines* which have been long since deduced by Consequences from the *Scripture*, and are now settled in the Body of that *Divinity*, which was deliver'd down to us by the *Primitive Church*, and which the generality of *Christendom* embraces: It may here be suggested, that the sensible *Knowledge* of *Things* may in time abolish most of these; by insinuating into Mens Minds that they cannot stand before the Impartiality of *Philosophical Inquisitions*. But this Surmise has no manner of Foundation. These Superstructures are of two Sorts: Either those of which a Man may have a clear Apprehension in his Thoughts, upon a rational Account, and which are intelligible to any ordinary Reader; or else such as exceed the common Measures of our *Reason* and *Senses*. There will be no Fear that an *Experimenter* should reject the first, seeing they may be conceiv'd by the meanest Capacity, and have that Stamp upon

§. XVIII.
Experiments will not overthrow the Doctrine of the Primitive Church.

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them, which he for the most part esteems the Character of *Truth*, that they are vulgar. But now towards the consenting to the last, there is nothing better than to believe them in gross; and for this he is as well prepar'd as any other *Philosopher*. If we suppose him sufficiently convinc'd of the Authority of the Deliverer, (as I have already shewn he may be) he cannot be suspected for disavowing his Word, though never so mystical, or for resisting the Voice of him whose Arm he has found to be Omnipotent. This Submission of his *Judgment* he may make, notwithstanding the Severity of his *Inquiries*; and the most subtil speculative Man in the World can do no more. After all his acute *Arguings* in *Divinity*, he can never render any one Point, which is the proper Object of *Faith*, to be plain, and equal, and expressible to our *Reason*. What good can he then do? seeing he is not able to make it any way fitter for our *Faith*, by all his *Transcendental Notions*, than it was before on the bare Account of the *wondrous Works* of the *Author*.

This is the Place in which the *Peripatetic Philosophy* has long triumph'd; but I cannot imagine on what Right. The spiritual and supernatural Part of *Christianity* no *Philosophy* can reach; and in the plain things there is no need of any at all; so that it is excluded on both Accounts. In some *Doctrines* it is useless, by reason of their Sublimity; in others, because of their Commonness. How small Assistance it brings, may be seen in those very Points in which its Empire seems most to be plac'd, in *God's Decrees*, his *Immateriality*, his *Eternity*, and the holy Mystery of the *Trinity*: in all which we are only brought into a more learned Darkness by it; and in which unfathomable Depths

Depths a plain *Believing* is at last acknowledg'd by all to be our only Refuge. The Truth is, notwithstanding the great Stir they have made about *Religion*, if we had only follow'd their Light, we had still worshipp'd the *Creator* and *Redeemer* of the *World* under the same Title by which their Predecessors did formerly at *Athens*, as the *unknown God*.

This I have urg'd so far, because I am confident that the reducing of *Christianity* to one particular Sect of *Philosophy*, and confining it to that, is one of the most destructive Engines that ever was manag'd against it. Of this the Church of *Rome*, for her Share, has already found the ill Effects: And the Danger is apparent: For by this means the Benefit of *Religion* will become very narrow, seeing where *Reason* takes Place, it will only convince them who are of the same Opinions in *Philosophy* with those that convert them: And also, (that which is worse) if ever by any Fate of *Times*, or Change of *Governments*, or Succession of new *Arts*, that Sect shall chance to be quite broken, the *Doctrine* of *Christ*, relying upon it, were inevitably ruin'd, unless *God* were pleas'd to support it a supernatural Way, or to restore it again by new *Miracles*. *Religion* ought not to be the Subject of *Disputations*: It should not stand in need of any Devices of *Reason*: It should in this be like the temporal Laws of all Countries, towards the obeying of which there is no need of *Syllogisms* or *Distinctions*; nothing else is necessary but a bare Promulgation, a common Apprehension, and Sense enough to understand the Grammatical Meaning of ordinary Words. Nor ought *Philosophers* to regret this Divorce; seeing they have almost destroy'd themselves, by keeping *Christianity* so long under their Guard; by fetching *Religion* out of the *Church*

and carrying it Captive into the *Schools*, they have made it suffer Banishment from its proper Place: And they have withal thereby very much corrupted the Substance of their own *Knowledge*: They have done as the *Philistines* by seizing on the *Ark*; who by the same Action depriv'd the People of *God* of their *Religion*, and also brought a Plague amongst themselves.

Sect. XIX.
Experiments
will not hin-
der the Pra-
lice of Re-
ligion.

THUS far I trust it will be confess'd, that *Experiments* are unblameable. But yet there is much more behind, of which many pious Men are wont to express their Jealousy. For though they shall be brought to allow, that all these *Doctrines*, which I have named, may seem to remain safe amidst the Studies of *Natural Things*: Yet they still whisper, that they may chance by degrees, to make the Sincerity of Devotion appear ridiculous, and to bring the Strictness of holy Life out of Fashion: And that so they will silently, and by Piece-meals, demolish *Religion*; which they dare not openly encounter. I will therefore next endeavour the Removal of these Scruples; though I sufficiently understand, that it is a very *difficult Work*, to confute such popular and plausible Errors, which have the Pretence of the Cause of *God* to confirm them.

The chief Substance of real and sober *Piety*, is contain'd in the devout Observation of all those Ways whereby *God* has been pleas'd to manifest his Will; and in a right Separation of our Minds from the Lusts and Desires of the *World*. The most remarkable Means, whereby he has made known his Pleasure, are those which have been fix'd and reveal'd in his *Word*; or else the extraordinary Signs of his Authority, and Command.

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Concerning our Acknowledgment of his *reveald Will* in the *Scripture*, I have already spoken. And our Obedience to the latter, consists chiefly of two Kinds; an humble Submission to *Divine Prophecies*; and a careful Observance of all *remarkable Providences*. In both which *Experimental Philosophy* may well be justify'd. It may perhaps correct some Excesses which are incident to them: But it declares no Enmity against the things themselves.

The Sum of all the whole *Doctrine of Prophecies* is this, that the *great Creator* of the World has the Prerogative of foreseeing, appointing, and predicting all future Events: That he has often, in former Ages, made use of this Power, by the Visions and Raptures of holy Men inspir'd from above; that his *infinite Wisdom* has still the like Ability to do the same; that whenever such Predictions are accompanied with undeniable Testimonies of their being sent from *Heaven*, they ought to be preferr'd before all *humane Laws*.

The true Foundation of *divine Prodigies*, is much of the same Nature with the other: It relies on these Suppositions, that all the Creatures are subject to *God's Word*, by which they were made; that he can alter their *Courses*, exalt or destroy their *Natures*, and move them to different Ends from their own, according to his Pleasure; that this he has often done heretofore; that still his Arm is not weakned, nor the same *Omnipotence* diminish'd; that still he may change the wonted Law of the *Creation*, and dispose of the *Beings* and *Motions* of all Things, without controul; and that when this is done, it is with a peculiar Design of punishing, or rewarding, or forewarning Mankind.

To the Belief and Assertion of these *Doctrines*, we are oblig'd by the very end of *Religion* itself. But yet their counterfeit Colours have seduc'd many virtuous Minds into manifold Mischiefs.

The Mistakes about *Prophecies* may arise either from our abusing of the old, or a vain setting up of new. We err in the first, when we translate the ancient *Prophecies* from those Times and Countries, which they did properly regard, to others, which they do not concern. And we offend in the second, when we admit of new *Prophetical Spirits* in this Age, without the uncontrollable Tokens of *Heavenly Authority*.

We are guilty of false Interpretations of *Providences* and *Wonders*, when we either make those to be *Miracles* that are none, or when we put a false Sense on those that are real; when we make general Events to have a private Aspect, or particular Accidents to have some universal Signification. Though both these may seem at first to have the strictest Appearance of *Religion*, yet they are the greatest Usurpations on the Secrets of the *Almighty*, and unpardonable Presumptions on his high *Prerogatives* of *Punishment* and *Reward*.

Sect. XX. AND now if a moderating of these Extravagancies must be esteem'd Prophaneness, I profess, I cannot abolish the *Experimental Philosopher*. It must be granted, that he will be very scrupulous, in believing all manner of Commentaries on *Prophetical Visions*, in giving Liberty to new *Predictions*, and in assigning the Causes, and marking out the Paths of *God's Judgments* amongst his *Creatures*.

He cannot suddenly conclude all extraordinary Events to be the immediate Finger of *God*, because he
familiarily

familiarly beholds the inward Workings of Things ; and thence perceives that many Effects, which use to affright the *Ignorant*, are brought forth by the common *Instruments of Nature*. He cannot be suddenly inclin'd to pass Censure on Mens eternal Condition, from any *Temporal Judgments* that may befall them ; because his long Converse with all Matters, Times, and Places, has taught him the Truth of what the *Scripture* says, that *all things happen alike to all*. He cannot blindly consent to all Imaginations of devout Men, about future *Contingencies* ; seeing he is so rigid in examining all particular Matters of Fact : he cannot be forward to assent to *Spiritual Raptures* and *Revelations*, because he is truly acquainted with the Tempers of Mens Bodies, the Composition of their Blood, and the Power of Fancy ; and so better understands the Difference between *Diseases* and *Inspirations*.

But in all this he commits nothing that is *irreligious*. 'Tis true, to deny that *God* has heretofore warn'd the World of what was to come, is to contradict the very Godhead itself ; but to reject the Sense, which any private Man shall fasten to it, is not to disdain the Word of *God*, but the Opinions of Men like ourselves. To declare against the Possibility, that new *Prophets* may be sent from *Heaven*, is to insinuate that the same infinite Wisdom, which once shew'd itself that Way, is now at an end. But to slight all Pretenders that come without the help of *Miracles*, is not a Contempt of the Spirit, but a just Circumspection, that the *Reason* of Men be not over-reach'd. To deny that *God* directs the Course of human Things, is Stupidity ; but to hearken to every *Prodigy*, that Men frame against their Enemies, or for themselves,

is not to reverence the *Power of God*, but to make that serve the Passions, and Interests, and Revenges of Men.

It is a dangerous Mistake, into which many good Men fall; that we neglect the *Dominion of God over the World*, if we do not discover, in every Turn of human Actions, many supernatural *Providences* and miraculous *Events*. Whereas it is enough for the Honour of his *Government*, that he guides the whole Creation, in its wonted Course of *Causes* and Effects: As it makes as much for the Reputation of a Prince's Wisdom, that he can rule his Subjects peaceably, by his known and standing Laws, as that he is often forc'd to make use of extraordinary Justice to punish, or reward.

Let us then imagine our *Philosopher* to have all slowness of Belief, and rigour of Trial, which by some is miscalled a blindness of Mind, and hardness of Heart. Let us suppose that he is most unwilling to grant that any thing exceeds the Force of *Nature*, but where a full Evidence convinces him. Let it be allow'd, that he is always alarm'd, and ready on his Guard, at the Noise of any *miraculous Event*; lest his Judgment should be surpriz'd by the Disguises of *Faith*. But does he by this diminish the *Authority of ancient Miracles*? Or does he not rather confirm them the more, by confining their Number, and taking care that every Falshood should not mingle with them? Can he by this undermine *Christianity*, which does not now stand in need of such extraordinary Testimonies from *Heaven*? or do not they rather endanger it, who still venture all its Truths on so hazardous a Chance? Who requires a Continuance of

Signs,

Signs and Wonders, as if the Works of our *Saviour*—and his *Apostles* had not been sufficient: Who ought to be esteem'd the most carnally minded, the *Enthusiast*, that pollutes his *Religion* with his own Passions, or the *Experimenter*, that will not use it to flatter and obey his own Desires, but to subdue them? Who is to be thought the greatest Enemy of the *Gospel*, he that loads Mens *Faiths* by so many improbable Things, as will go near to make the Reality itself suspected, or he that only admits a few *Arguments*, to confirm the *Evangelical Doctrines*, but then chuses those that are *unquestionable*? It cannot be an ungodly purpose to strive to abolish all *Holy Cheats*, which are of fatal Consequence, both to the Deceivers, and those that are deceiv'd: To the Deceivers, because they must needs be *Hypocrites*, having the Artifice in their keeping: To the Deceiv'd, because if their Eyes shall be ever open'd, and they chance to find, that they have been deluded in any one thing, they will be apt not only to reject that, but even to despise the very *Truths* themselves, which they had before been taught by those Deluders.

It were indeed to be confess'd, that this Severity of *Censure on Religious Things*, were to be condemn'd in *Experimenters*, if while they deny any Wonders that are falsely attributed to the *True God*, they should approve those of Idols or false *Deities*. But that is not objected against them. They make no Comparison between his Power, and the Works of any others, but only between the several ways of his own manifesting himself. Thus if they lessen one Heap, yet still they increase the other: In the main they diminish nothing of his Right. If they take from the *Prodigies*, they add to the ordinary *Works* of the

same *Author*. And those ordinary *Works* themselves, they do almost raise to the height of *Wonders*, by the exact Discovery which they make of their Excellencies : While the *Enthusiasts* goes near to bring down the Price of the true and primitive *Miracles*, by such a vast, and such a negligent augmenting of their Number.

Sect. XXI. BY this I hope it appears, that this inquiring, this scrupulous, this incredulous Temper, is not the Disgrace, but the Honour of *Experiments*. And therefore I will declare them to be the most seasonable Study, for the present *Temper* of our *Nation*. This wild amusing Mens Minds with *Prodigies*, and Concoits of *Providences*, has been one of the most considerable Causes of those spiritual Distractions, of which our Country has long been the *Theatre*. This is a Vanity to which the *English* seem to have been always subject above others. There is scarce any *Modern Historian*, that relates our Foreign Wars, but he has this *Objection* against the *Disposition* of our Countrymen, that they us'd to order their Affairs of the greatest Importance, according to some obscure *Omens*, or *Prædictions*, that pass'd about amongst them, on little or no Foundations. And at this time, especially this last Year, this gloomy, and ill-boding humour has prevail'd. So that it is now the fittest Season for *Experiments* to arise, to teach us a Wisdom, which springs from the depths of *Knowledge*, to shake off the Shadows, and to scatter the Mists, which fill the Minds of Men with a vain Consternation. This is a *Work* well-becoming the most *Christian Profession*. For the most apparent Effect, which attended the Passion of *Christ*, was the putting of an eternal silence

on

on all the false Oracles, and dissembled Inspirations of *ancient Times*.

There have been, 'tis true, some peculiar Occasions wherein *God* was pleased to convince the World from *Heaven* in a visible manner. But if we consider the *Arguments* that us'd to move him to it, we may conclude that such wonderful Signs are not often now to be expected.

He has either done it in Times of gross Ignorance, or in the beginning of a new way of *Religion*, or for the peculiar Punishment of some prevailing Wickedness: Upon the account of the two first, we have no reason to expect Wonders in this *Age*: Because all sorts of *Knowledge* do so much abound; and because we have a *Religion* already establish'd, against which the Gates of Hell shall never prevail.

The third time has been, when *God* has taken to himself, the *Exemplary Punishment* of some heinous Sin. From this indeed our *Age* is no more exempted, than it is free from those Vices that are wont to provoke the *Divine Vengeance*. This then we confess, that even at this present *God* may declare himself against the Iniquities of Men, by the supernatural Tokens of his Displeasure: But yet the Interpretation of such Punishments ought to be handled with the greatest Tendernefs. For as it is said of the last and general Judgment, *that no Man knows the time when it shall happen*; so we may also affirm of these particular *Judgments*, That there is no Man who understands the Circumstances, or Occasions of their Infliction, but they are one of the deepest parts of *God's* unsearchable Councils.

Whenever therefore a heavy Calamity falls from *Heaven* on our *Nation*, an *universal Repentance* is re-

quir'd; but all particular Applications of private Men, except to their own Hearts, is to be forborn. Every Man must bewail his own *Transgressions*, which have increas'd the *Publick Ministry*. But he must not be too hasty in assigning the Causes of *Plagues*, or *Fires*, or *Inundations*, to the Sins of other Men. Whoever thinks that way to repent, by condemning the Miscarriages of those Parties that differ from his own, and by reproving them as the *Authors* of such *Mischiefs*, he is grossly mistaken: For that is not to repent, but to make a Satire: That is not an Act of Humiliation, but the greatest *Spiritual Pride*.

It is indeed a Disgrace to the Reason and Honour of Mankind, that every fantastical *Humourist* should presume to interpret all the *secret Ordinances of Heaven*; and to expound the Times, and Seasons, and Fates of Empires, though he be never so ignorant of the very common *Works of Nature* that lie under his Feet. There can be nothing more injurious than this, to Mens publick or private Peace. This withdraws our Obedience from the true Image of *God*, the rightful Sovereign, and makes us depend on the vain Images of his Power, which are fram'd by our own *Imaginations*: This weakens the Constancy of human Actions: This affects Men with Fears, Doubts, Irresolutions, and Terrors. It is usually observ'd, that such *Presaging*, and *Prophetical Times*, do commonly fore-run great *Destructions* and *Revolutions* of human Affairs. And that it should be so is natural enough, though the *Presages* and *Prodigies* themselves did signify no such Events. For this *melancholy*, this *frightful*, this *Astrological* humour disarms Mens Hearts, it breaks their Courage, it confounds their Councils, it makes them help to bring
such

such *Calamities* on themselves: First, they fancy that such ill Accidents must come to pass; and so they render themselves fit Subjects to be wrought upon; and very often become the *Instruments*, to bring those Effects about, which they fondly imagin'd were inevitably threaten'd them from *Heaven*.

THE last *Accusation* concerns that which is necessary to a *holy Life*, the *mortifying* of our *Earthly Desires*. And here the Men of a retir'd and severe Devotion are the loudest: For they tell us, that we cannot conquer and despise the *World* while we study it so much: that we cannot have sufficient leisure to reflect on another Life, while we are so taken up about the Curiosities of this; that we cannot be strict enough in correcting the Irregularities of our own Thoughts, while we give them so much liberty to wander, and so pleasant a Road wherein to travel; and that it is in vain to strive after the *Purity* and *Holiness* of our Minds, while we suffer them to spend so much Time on the Labours of our *Senses*. This *Objection* appears at first sight somewhat terrible: But I come the more boldly to answer it, because there are involv'd in the same Indictment, all the most innocent *Arts*, and civil *Actions* of Men, which must either stand or fall with *Experiments* in this Trial.

Sect. XXII.
*Experiments
not prejudicial to Mortification.*

First then I will alledge, that if this sort of *Study*, should be acknowledg'd not to be proper, for the promoting of the severer Offices of *Christianity*, yet it would sufficiently recompence for that, by the Assistance it may bring to some other kinds of *Christian Virtues*: If it shall not fill our Minds with the most mortifying Images, which may rise from the Terrors

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of *God's Justice*, yet it will make amends for that, by inclining us to adore his *Goodness*. If it fits us not so well for the Secrecy of a *Closet*, it makes us serviceable to the *World*. If it shall not seem to contribute towards *Godly Sorrow*, or *Contrition*, it will give us more Opportunities of *Charity*, *Affability*, *Friendship*, and *Generosity*, which are all of them *Divine Graces*, as well as *Faith*, and *Repentance*.

It is a great Error to think that *Religion* does only consist in one sort of *Duties*. It is as various as the Dispositions, the Qualities, the Conditions of Men: With some, the severe, the strict, the retir'd are best: with others, the bountiful, the affable, the cheerful, the friendly: Of both which kinds I will not say whether is to be preferr'd: But this is true, that while the first are chiefly limited to the regulating of our own *Hearts*, the influence of the last extends much farther; to spread the Fame of the *Gospel* in the *World*; to make it appear lovely in the Eyes of all Beholders; and to allure them to submit to the honourableness, the gentleness, the easiness of its Yoke. And this methinks is evident in our *Saviour's* Life: For whenever he intended to convert any to his *Faith*, he did it by some visible *good Work*, in the sight of the Multitude. But he never gain'd any *Disciple* by the Conflicts which he was pleas'd to undergo in his own Mind; for he perform'd his *Fast*, and his *Agony* alone, in the *Wilderness*, and the *Garden*.

In the next place I will affirm, That it is improbable that even the hardest and most rigorous parts of *Mortification* itself should be injur'd by these *Studies* more than others; seeing many Duties of which it is compos'd, do bear some resemblance to the Qualifications

cations that are requisite in *Experimental Philosophers*. The spiritual *Repentance* is a careful survey of our former Errors, and a Resolution of amendment. The spiritual *Humility* is an Observation of our Defects, and a lowly Sense of our own Weakness. And the *Experimenter* for his part must have some Qualities that answer to these: He must judge aright of himself; he must misdoubt the best of his own Thoughts; he must be sensible of his own Ignorance, if ever he will attempt to purge and renew his Reason. So that if that be true, which is commonly observ'd, that Men are wont to prove such kinds of *Christians* as they were Men before; and that Conversion does not destroy, but only exalt our *Tempers*; it may well be concluded, that the doubtful, the scrupulous, the diligent *Observer* of Nature, is nearer to make a modest, a severe, a meek, an humble *Christian*, than the Man of *Speculative Science*, who has better thoughts of himself and his own *Knowledge*.

But I need not take so great a Compass in this Vindication, when it may be fairly maintain'd, that the true and unfeign'd *Mortification* is not at all inconsistent with Mens consulting of their Happiness in this World, or being employ'd about earthly Affairs. The honest pursuit of the Conveniencies, Decencies, and Ornaments of a mortal Condition, by just and regular ways, is by no means contradictory to the most real and severe Duties of a *Christian*. It is true indeed, the irregular Prosecution of such Things is an offence to *Religion*: but so it is also to *right Reason*, and *Nature* itself.

It is a wrong Conception of the State of *Grace*, if Men believe, that when they enter upon it, they must presently cast away all the Thoughts and Desires
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of *Humanity*. If this were so, to sanctify our *Natures*, were not to renew, but to destroy them. When we are commanded to *put off the old Man*, we are not enjoin'd to renounce our Faculties of *Reason*. When we are bidden *not to think our own Thoughts*, it is not intended that we should forbear all *Natural Actions* and *Inclinations*. Such *Scriptures* as these are to be understood in a moderate Sense: By such Expressions the Irregularity of the *Lust*, and not the *Natural Desire* is condemn'd; the *Piety* and *Innocence* of our *Lives*, and not the utter Change of our *Estate*, is recommended. Seeing the *Law of Reason* intends the Happiness and Security of Mankind in this Life; and the *Christian Religion* pursues the same Ends, both in this and a future Life; they are so far from being opposite one to another, that *Religion* may properly be stiled the best and the noblest Part, the Perfection and the Crown of the *Law of Nature*.

I will therefore first demand, whether it be not lawful for the strictest *Christian* to provide for the Necessities of this Life? This Request is modest enough: For if they deny it, they will reduce Mankind into a Condition which is literally worse than that of the Beasts that perish; seeing to them it is natural to seek out for all the ways of their own Preservation. I will go on to ask them, whether it be a Breach of the *Law of Christianity*, to labour for the Advantages of Living, which are enjoy'd by others? If this be refus'd me, we shall not deprive it of that Honour which now justly belongs to it, that there is little Civility at present amongst Men without the Pale of the *Christian Church*.

But, in few Words, let them tell me, whether it be indispensably necessary for us to be always thinking
of

of heavenly Things? If so, how far short were the very Apostles of this Character of *Sanctity*, which these Men would prescribe us? What Traffick, what Commerce, what Government, what secular Employment could be allowed? Where should we at last make an end of refining? What would become of all the Men of Trade themselves, of whom this Age has shewn so many Pretenders to the purest *Religion*.

Let it only therefore be granted, that we are *Men*, and not *Angels*: Let it be confess'd, that there may be an *Excess*, as well as *Defect*, in Men's Opinions of Holiness: And then I will make no scruple to say, that the *Philosopher* defiles not his Mind when he labours in the *Works of Nature*; that the Diversion they give him, will stand with the greatest Constancy, and the Delight of pursuing them, with the Truth and Reality of *Religion*. But to say no more, How can it be imagin'd to be a sinful and carnal Thing, to consider the Objects of our *Senses*; when *God*, the most *spiritual Being*, did make them all? Since they first were conceiv'd in his unspotted Mind, why may they not innocently enter into ours? For if there be any Pollution which necessarily flows from thinking of them, it might as well be concluded to stick on the *Author*, as on the *Souls* of them that only observe them.

AND now having insisted so long on the Parts of the *Christian Religion* in General, it will be less needful that I should be large in vindicating this *Design* from the Imputation of being prejudicial to the *Church of England*: For this has the same Interest with that, and differs in nothing from its primitive Pattern, but only in the addition of some Circumstances, which make it fit for this *Age*, and this *Place*: And therefore they

§. XXIII.

Experiments

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— will both be strengthen'd by the same Benefits, and weaken'd by the same Mischiefs.

What I have then to add concerning our *Church*, shall be compriz'd in these Particulars : That it can never be prejudic'd by the Light of *Reason*, nor by the Improvements of *Knowledge*, nor by the Advancement of the *Works* of Mens Hands.

For the proof of the First, it will be sufficient to consider its *True Design*, what *Opinions* it principally encounters, and by what *Arguments* it ought to defend itself.

— The true and certain Interest of our *Church* is to derive its *Doctrine* from the plain and unquestion'd parts of the *Word of God*, and to keep itself in a due Submission to the *Civil Magistrate*. The Extremes which it opposes, are *implicit Faith*, and *Enthusiasm* : And it is a great Mistake, if Men think it cannot be maintain'd against these, but by the mutual *Arguments* of its Enemies ; that it cannot withstand the *Separatists*, but by the Authority of the *Church of Rome* ; nor dissent from the *Church of Rome*, but on the *Tenents* of the *Separatists*. The Grounds on which it proceeds are different from both ; and they are no other but the Rights of the *Civil Power*, the Imitation of the first uncorrupt *Churches*, and the *Scripture* expounded by *Reason* : From whence may be concluded, that we cannot make War against *Reason*, without undermining our own Strength, seeing it is the constant Weapon we ought to employ.

From this I will farther urge, That the *Church of England* will not only be safe amidst the Consequences of a *Rational Age*, but amidst all the Improvements of *Knowledge*, and the Subversion of old Opinions about *Nature*, and Introduction of new ways of reasoning

soning thereon. This will be evident, when we behold the Agreement that is between the present *Design* of the *Royal Society*, and that of our *Church* in its Beginning. They both may lay equal claim to the word *Reformation*; the one having compass'd it in *Religion*, the other purposing it in *Philosophy*. They both have taken a like course to bring this about; each of them passing by the *corrupt Copies*, and referring themselves to the *perfect Originals* for their Instruction; the one to the *Scripture*, the other to the large Volume of the *Creatures*. They are both unjustly accus'd by their Enemies of the same Crimes, of having forsaken the *Ancient Traditions*, and ventur'd on *Novelties*. They both suppose alike, that their *Ancestors* might err; and yet retain a sufficient Reverence for them. They both follow the great Precept of the *Apostle*, of *trying all Things*. Such is the Harmony between their *Interests* and *Temper*. It cannot therefore be suspected, that the *Church of England*, that arose on the same Method, though in different Works; that heroically pass'd through the same Difficulties, that relies on the same *Sovereign's Authority*, should look with jealous Eyes on this *Attempt*; which makes no change in the Principles of Mens Consciences, but chiefly aims at the Increase of *Inventions* about the *Works* of their Hands.

This was the last Particular in this Subject which I undertook to make good; That our *Church* can never be impair'd by the Growth of the useful *Arts of Life*. But now I come nearer to it, I find that I may safely omit it: For the thing itself is so manifest, that there can be no ground of raising a Question about it. If our *Church* should be an Enemy to Commerce, Intelligence, Discovery, Navigation, or any sort of *Mechanics*;

nics; how could it be fit for the present *Genius* of this *Nation*? What greater Advantage could its Adversaries have against it? How should we be able to reconcile these two Titles, which so justly belong to our *King*, of *Defender of the Faith*, and *Patron of Experimental Knowledge*.

But in this I am not only encourag'd to promise, that our *Church* will be out of all danger; but to recommend this *Enterprize* to it, as that which will become its other *Excellencies*, and is most worthy of its *Protection*. And I shall most humbly represent to its Consideration, that this is not only an honourable *Work*, but even a necessary *Duty*, to which it is oblig'd by *Natural Affection*. The present *inquiring Temper* of this *Age* was at first produc'd by the Liberty of Judging, and Searching, and Reasoning, which was us'd in the first *Reformation*. Though I cannot carry the Institution of the *Royal Society* many Years back, yet the Seeds of it were sown in King *Edward* the Sixth's and Queen *Elizabeth*'s Reign: And ever since that time *Experimental Learning* has still retain'd some vital Heat, though it wanted the Opportunities of ripening itself, which now it enjoys. The *Church of England* therefore may justly be styl'd the *Mother* of this sort of *Knowledge*; and so the Care of its *Nourishment* and *Prosperity* peculiarly lies upon it.

And indeed this is an Honour which seems reserv'd for it alone. For all the several sorts of *Enthusiasts*, I fear, there cannot much help be expected towards such *Works*, till they shall have left off to abhor them under the Title of *vain Philosophy*.

The *Reformed Churches* of other Countries, though they have given us many Men, who have been eminent in this way, yet are not in a Condition to promote

note it by themselves: For either they have not the Encouragement of the *Magistrate*; or those that have, are cut so short in their Revenue, that they have scarce enough to support the Decence of their own publick Worship.

The *Church of Rome* has indeed of late look'd more favourably upon it. They will now condemn no Man for asserting the *Antipodes*: The Severity with which they handled *Galileo*, seems now very much abated: They now permit their *Jesuits* to bestow some Labours about *Natural Observations*, for which they have great Advantages by their Travels; and their *Clergy* may justly claim some share in this Honour, as long as the immortal Names of *Mersennus* and *Gassendus* shall live.

But still it is a question, whether that *Church* does not rather connive at, than really intend its Progress. They have indeed seiz'd on some parts of *New Philosophy*; but perhaps it is only with the same Policy that we often see great *Monarchs* use, in retaining some Out-Province of their *Empire*; who, though they find that the Benefit does not countervail the Charge of the keeping it, yet will not wholly quit their Interest in it, lest their *Neighbours* should get Possession, and fortify it against them. Thus it is likely they have cherish'd some *Experiments*, not out of Zeal to the continuance of such *Studies*, but that the *Protestants* might not carry away all the Glory, and thence withal get new Strength to oppose them.

This Undertaking therefore is wholly cast on the *Church of England*, which can have no Jealousy of its Effects, to which *Ignorance* is not a Support, but an Enemy; which aims not at the Captivity, but the Freedom of Mens Minds; which is lately return'd to

a prof-

a prosperous Condition, and having suffer'd with the *Crown* in its Misfortunes, does now partake of the happy Fruits of its *Restoration*.

Nor will *Experimental Philosophy* be unthankful for the Assistance it shall receive: For it will enable us to provide beforehand, against any Alterations in *Religious Affairs*, which this *Age* may produce. If we compare the Changes to which *Religion* has been always subject, with the present face of Things, we may safely conclude, That whatever Vicissitude shall happen about it in our time, it will probably neither be to the Advantage of *implicit Faith*, nor of *Enthusiasm*, but of *Reason*. The Fierceness of *violent Inspirations* is in good measure departed: The Remains of it will be soon chas'd out of the World, by the remembrance of the terrible Footsteps it has every where left behind it. And though the *Church of Rome* still preserves its Pomp, yet the real Authority of that too is apparently decaying. It first got, by degrees, into *Temporal Power*, by the means of its *Spiritual*; but now it only upholds some Shadow of the *Spiritual*, by the Strength of the *Temporal Dominion* it has obtain'd.

This is the present State of *Christendom*. It is now impossible to spread the same Clouds over the World again: The universal Disposition of this *Age* is bent upon a *rational Religion*: And therefore I renew my affectionate Request, that the *Church of England* would provide to have the chief Share in its first Adventure; that it would persist, as it has begun, to encourage *Experiments*, which will be to our *Church* as the *British Oak* is to our *Empire*, an Ornament, and Defence to the Soil wherein it is planted.

Thus I have finish'd what I intended concerning *Religion*: wherein I desire it might not be thought that

that I have defended every particular *Searcher* into *Nature*. That could not be justly expected from me ; for there is no Man that makes an *Apology* for any general way, who will take upon him to make good all the Actions of all private Men who profess it. It is enough for my Purpose, if it shall be granted, that however some *Experimenters* may be inclinable to Irreligion ; yet this rather proceeds from their own *Genius*, than from any Corruption that could be contracted from these *Studies* ; and that if the same Men had profess'd *Physic*, or *Law*, or even *Divinity* itself, they would have been in like manner disaffected towards heavenly Things.

I cannot deny, but that some *Philosophers*, by their Carelessness of a future Estate, have brought a Discredit on *Knowledge* itself : But what Condition of Men is free from such Accusations ? Or why must we strait believe that their Impiety proceeds from their *Philosophy* ? It is easy for Men to fall into gross Errors, and to mistake the wrong Causes for the true ; in the Judgment which they make of others Opinions and Inclinations : When they behold them addicted to such or such Vices, and to have withal some good Qualities, in which they themselves do not excel, they presently are apt to imagine the *bad* to arise from the *good*, and so condemn both together ; whereas perhaps it sprung from some other hidden Cause, of which they took no notice.

But let it be a true *Observation*, That many *Modern Naturalists* have been negligent in the *Worship of God* ; yet perhaps they have been driven on this Prophaneness by the late extravagant Excesses of *Enthusiasm*. The infinite Pretences to *Inspiration*, and *immediate Communion with God*, that have abounded
in

in this *Age*, have carry'd several Men of Wit so far, as to reject the whole Matter; who would not have been so exorbitant, if the others had kept within more moderate Bounds. This is natural enough to be suppos'd; for so it has commonly happen'd, that the greatest Degrees of all *contrary Opinions* have met in the same *Age*, and have still heighten'd and increas'd each other.

From hence it may be gather'd, That the way to reduce a *real* and *sober* Sense of *Religion*, is not by endeavouring to cast a Veil of Darkness again over the Minds of Men; but chiefly by allaying the Violence of *spiritual Madness*: and that the one Extreme will decrease proportionably to the lessning of the other.

— It is apparent to all, That the Influence which *Christianity* once obtain'd on Mens Minds, is prodigiously decay'd. The Generality of *Christendom* is now well-nigh arriv'd at that fatal Condition, which did immediately precede the Destruction of the Worships of the ancient World; when the Face of *Religion* in their public *Assemblies*, was quite different from that Apprehension which Men had concerning it in private: In publick they observ'd its Rules with much Solemnity, but in private regarded it not at all. It is difficult to declare by what Means and Degrees we are come to this dangerous Point: But this is certain, that the *Spiritual Vices* of this *Age* have well-nigh contributed as much towards it, as the *Carnal*: And for these, the most efficacious *Remedy* that Man of himself can use, is not so much the sublime part of *Divinity* as its intelligible, and natural, and practicable *Doctrines*. The *Medicines* for *Religious Distempers* must be changeable according to the *Diseases*: And in this

we may imitate *Christ* himself in his Method of healing Mens Bodies: Some Cures he perform'd by his Voice, some by Prayer, but some by the touch of his Hands, and even by his Spittle mingled with Earth. In a gross and sensual *Age*, the deepest Mysteries of our *Religion* may be proper to purify the Stupidity of Mens Spirits; but there must be an Application of quite different and more sensible Prescriptions, in a subtile, refined, and enthusiastical Time.

Such is the present Humour of the *World*; and such must be the Course of its Cure. Men must now be told, that as *Religion* is a *heavenly Thing*, so it is not utterly averse from making use of the Rules of *Human Prudence*: They must be inform'd, that the *true Holiness* is a Severity over our selves, and not others: They must be instructed, that it is not the best Service that can be done to *Christianity*, to place its chief Precepts so much out of the Way, as to make them unfit for Men of Business. They must remember, that the chief of the *Apostles became all Things to all Men, that he might gain some*. But above all, there must be Caution given, that Men do not strive to make themselves, and their own Opinions, ador'd, while they only seem zealous for the Honour of *God*. This is a Fault which is very incident to Men of *Devotion*; for when they have once form'd in themselves a *perfect Model* of the *Will of God*, and have long confirm'd their Minds by continual thinking upon it, they are apt to condemn all others that agree not with them in some Particulars. Upon this, they have strait the reproachful Term of *Atheists* to cast upon them; which tho' it be a Title that ought only to be employ'd against the bold and insolent Defiers of *Heaven* in their *Words* and *Actions*, yet it is too frequently us'd to express

the Malice of any eager and censorious Spirit, that has the Confidence to object it.

— This, and all other the like *Principles of Uncharitableness*, are to be oppos'd by asserting the Duties of the *Law of Nature*, by the use of past and present *Times*, by the *Analogy* of human things, by *Moral Virtue*, by the Offices of *Society*, by the Contemplation of *God's visible Works*, and such easy and rational *Arguments*. Next to the Succour of *Divine Power*, this is the most probable way to preserve the *Christian Faith* amongst us; if *God* has not in his Wrath resolv'd to transplant it into some other quarter of the *Earth*, which has not so much neglected his Goodness. This indeed were a Revolution, which cannot be thought on without Horror. The Subversion of all *Europe* would attend it. The Departure of the *Christian Profession* would be accompanied with as frightful Effects, as those which follow'd on the Death of its *Founder*; when the *Heavens* were darken'd, the *Temple* shook, the Vail was rent; the *Earth* trembled, and the *Philosopher* had reason to cry out, *That either Nature was dissolving, or the God of Nature dying.*

§. XXIV.
*Experiments
advantage-
ous to Ma-
nual Arts,*

I will now enter on the next Member of my *Division*, to consider the Purpose of the *Royal Society*, and the probable Effects of *Experiments*, in respect of all the *Manual Trades* which have been heretofore found out and adorn'd. And I will dispatch this *Argument* in the Resolution of these four Questions.

Whether the *Mechanic Arts* are still improveable by human *Industry* :

Whether it be likly, that they may be advanc'd by any others, besides the *Mechanic Artists* themselves ?

Whe-

Whether there be any ground of hope from *Experiments*, towards this Work?

And whether if such *Arts* shall hereby happen to multiply, they will not ruin those *Trades* that are already settled.

If in these Particulars I shall answer my Readers Doubts, I trust it will be granted me, that it is not a vain or impossible Design, to endeavour the increase of *Mechanic Contrivances*; that the Enterprize is proper for a mixt *Assembly*; that the Course which they observe towards it will be effectual; and that the increase of such *Operations* will be inoffensive to others of the same kind, that have been formerly discover'd.

Before I examine these several *Heads* apart, perhaps it will not be an impertinent Labour, to take one general Survey of the principal Degrees and Occasions, by which the several *Manufactures* have risen, which beautify the face of the *Earth*, and have brought forth so much Pleasure and Plenty amongst Men.

The first of all human Race, when they were dispers'd into several Lands, were at first sustain'd by the *Fruits* of the *Earth*, which fell to their Share. These at first they cherish'd, and us'd, not by any *Rules* of *Art*, but by that natural *Sagacity*, which teaches all Men to endeavour their own Preservation. For the peaceable Enjoyment of these, they combin'd into Families, and little Leagues, which were the Beginnings of *Civil Government*. But finding that all Places did not bring forth all Things for Cloathing, Food, and Defence, they either violently seiz'd on what their Neighbours possess'd, or else they fairly agreed on a *mutual Exchange* of the Productions of their Soils. This Traffick was at first made in Kind;

and the *Fruits* that were thus barter'd, were either spent, or planted in other Grounds. By this means Mankind was maintain'd ; and several *Earths* were furnish'd by *Labour*, with what *Nature* bestow'd not upon them. For this *Commutation* of their *Fruits*, and of the rude Effects of their first Industry, they began to devise the Conveniencies of *Carriage* by Land and Water ; and to make it still easier, and larger, they agreed on some common Things, to be the universal Standard of *Value* and *Price* ; whence arose the use of *Money*.

This was the first Original of *Trade*, which from a narrow Commerce between the Hills, the Valleys, the Woods, the Plains, and the Rivers that border'd one upon another, is since extended to the whole Compass of the *Earth*. For in course of Time, the small Clans, and natural Commonwealths were devour'd by the Strength of the greater ; or else some of the wiser Men reduc'd the rude Multitude into one Place, and perswaded them to live quietly under the *Laws*. From thence Mankind began to have the face of *Civility*, which arose at first, by that which is the best Means of preserving it now, by the *greatness* and *enlargement* of *Dominion*.

The first, all the Differences of *Living*, and the Advantages of *Strength* and *Empire*, did shew themselves. Then some took on them to *Rule*, some to *Assist*, or *Council* those that Rul'd, and some were forc'd to be subject to their Power. Thus the *Riches* and *Dominion* that were at first in common, were unequally divided : The Great, the Wise, or the Strong, obtain'd a principal Share ; and either perswaded, or constrain'd all the rest to serve them with their Bodies. Thence sprung all the *Arts* of *Convenience*

ence and *Pleasure*, while the one part of Men would not be content to live according to the first Plainness of *Nature*: And the other were compell'd to work with their Hands, for the Ease and Pleasure of their *Masters Lives*, and the Support of their own. From these Beginnings the Inventions of *Peace* and *War*, the Delights of *Cities* and *Palaces*, the Delicacies of *Food*, the Curiosities of *Cloathing*, the Varieties of *Recreations* took their Rise: And these have still continued to increase, either by some casual Discoveries, or by *Luxury*, or else as Men have been driven by some new *Necessities*, to pass on farther to attempt new ways of maintaining themselves.

THIS is the most *natural Method* of the Foundation and Progress of *Manual Arts*. And they may still be advanc'd to a higher Perfection, than they have yet obtain'd, either by the Discovery of new *Matter*, to employ Mens Hands, or by a new *Transplantation* of the same *Matter*, or by handling the old Subjects of *Manufactures* after a new way, in the same Places.

Sect. XXV.
The Manual Arts are still improveable.

And first, we have reason to expect, that there may still arise new *Matter* to be manag'd by *Human Art* and *Diligence*; and that from the parts of the *Earth* that are yet unknown, or from the new discover'd *America*, or from our own Seas and Land, that have been long search'd into, and inhabited.

If ever any more *Countries*, which are now hidden from us, shall be reveal'd, it is not to be question'd, but there will be also opened to our *Observation*, very many kinds of *living Creatures*, of *Minerals*, of *Plants*, nay, of *Handicrafts*, with which we have been hitherto unacquainted. This may well be expected, if we remember, that there was never yet any

First by new Matter from new Lands.

Land

Land discover'd, which has not given us divers new sorts of *Animals*, and *Fruits* of different Features and Shapes, and Virtues from our own, or has not supplied us with some new artificial *Engine*, and *Contrivance*.

And that our *Discoveries* may still be enlarg'd to farther *Countries*, it is a good Proof, that so many spacious Shores and Mountains, and Promontories, appear to our *Southern* and *Northern Sailors*; of which we have yet no Account, but only such as could be taken by a remote Prospect at Sea. From whence, and from the Figure of the *Earth*, it may be concluded, that almost as much space of Ground remains still in the *Dark*, as was fully known in the times of the *Assyrian* or *Persian Monarchy*. So that without assuming the vain prophetick Spirit, which I lately condemn'd, we may foretel, that the *Discovery* of another *new World* is still behind.

To accomplish this, there is only wanting the *Invention of Longitude*, which cannot now be far off, seeing it is generally allow'd to be feasible, seeing so many Rewards are ready to be heap'd on the *Inventors*; and (I will also add) seeing the *Royal Society* has taken it into its peculiar care. This, if it shall be once accomplish'd, will make well-nigh as much alteration in the *World*, as the *Invention* of the *Needle* did before: And then our Posterity may outgo us, as much as we can travel farther than the *Antients*; whose *Demy Gods* and *Heroes* did esteem it one of their chief Exploits, to make a Journey as far as the *Pillars of Hercules*. Whoever shall think this to be a desperate Business, they can only use the same *Arguments*, wherewith *Columbus* was at first made ridiculous, if he had been discourag'd by the Raillery of his

his Adversaries, by the Judgment of most *Astronomers* of his time, and even by the Intreaties of his own *Companions*; but three Days before he had a sight of *Land*, we had lost the Knowledge of half the *World* at once.

AND as for the new discover'd *America*, 'tis true, §. XXVI. that has not been altogether useless to the *Mechanic* *Arts*: But still we may guess, that much more of its Bounty is to come, if we consider, that it has not yet been shewn above *two hundred Tears*; which is scarce enough time to travel it over, describe, and measure it, much less to pierce into all its Secrets. Besides this, a good part of this Space was spent in the *Conquest* and *settling* the *Spanish Government*, which is a Season improper for *Philosophical Discoveries*. To this may be added, that the chief Design of the *Spaniards* thither, has been the Transportation of *Bullion*; which being so profitable, they may well be thought to have overseen many other of its *Native Riches*. But above all, let us reflect on the Temper of the *Spaniards* themselves: They suffer no Strangers to arrive there: they permit not the *Natives* to know more than becomes their Slaves. And how unfit the *Spanish* humour is to improve *Manufactures*, in a Country so distant as the *West-Indies*, we may learn by their Practice in *Spain* itself, where they commonly disdain to exercise any *Manual Crafts*, and permit the Profit of them to be carried away by Strangers.

From all this we may make this *Conclusion*, That if ever that vast Tract of *Ground* shall come to be more familiar to *Europe*, either by a *free Trade*, or by *Conquest*, or by any other *Revolution* in its Civil Affairs, *America* will appear quite a new Thing to us; and

Mechanics
improveable
by new Mat-
ter from
America.

and many furnish us with an abundance of *Rarities*, both Natural and Artificial; of which we have been almost as much depriv'd by its present *Masters*, as if it had still remain'd a part of the *unknown World*.

§. XXVII. *By new Matter from the World.* BUT lastly, to come nearer home, we have no ground to despair, but very much more *Matter*, which has been yet unhandled, may still be brought to light, even in the most civil and most peopled Countries; whose *Lands* have been thoroughly measur'd by the Hands of the most *exact Surveyors*; whose underground *Riches* have been accurately pry'd into; whose Cities, Islands, Rivers, and Provinces, have been describ'd by the Labours of *Geographers*. It is not to be doubted, but still there may be an infinite number of *Creatures* over our Heads, round about us, and under our Feet, in the large Space of the *Air*, in the Caverns of the *Earth*, in the Bowels of *Mountains*, in the Bottom of *Seas*, and in the Shades of *Forests*, which have hitherto escap'd all *mortal Senses*. In this the *Microscope* alone is enough to silence all Opposers. Before that was invented, the chief help that was given to the Eyes by *Glasses*, was only to strengthen the dim Sight of old *Age*; but now by the means of that excellent *Instrument*, we have a far greater Number of different kinds of Things reveal'd to us, than were contain'd in the visible Universe before; and even this is not yet brought to *Perfection*: The chief Labours that are publish'd in this way, have been the *Observations* of some *Fellows* of the *Royal Society*, nor have they as yet apply'd it to all Subjects, nor tried it in all Materials and Figures of *Glass*.

To the *Eyes* therefore there may still be given a vast addition of *Objects*: And proportionably to
all

all the other Senses. This Mr. *Hook* has undertaken to make out, that *Tasting, Touching, Smelling, and Hearing*, are as improveable as the *Sight*; and from his excellent *Performances* in the one, we may well rely on his *Promise* in all the rest.

The next *Encrease* of *Manual Arts* which is proba- § XXVIII.
ble to succeed, may happen by the farther *Transplant- Mechanics*
ing and *Communicating* of the several *Natural Com- improveable*
modities of all *Nations*, to other *Airs*, and other *Soils*, *by Trans-*
and other ways of *Cultivation*. That this is not yet *plantations*.

finish'd, is evident, in that there is no *Land* so well furnish'd as to produce all the various sorts of Things, which its Ground and Temperature is capable to receive; and also, because many of the most fertile *Countries* contain large Spaces that are utterly Barren.

This *Work* then may be farther advanc'd, by three kinds of Endeavours.

The first by *Transplanting* out of one Land into another, of the same Situation in respect of the *Heavens*. This may be try'd by conveying the *Eastern Spices*, and other useful *Vegetables*, into our *Western Plantations*. Nor can it be imagin'd, why they should thrive in one *Indies*, and not in the other; why their *Soil* should not be as good where the *Sun* sets, as where it rises; seeing there are parts of both, which lie under the same Influence of that, and the other *Celestial Bodies*, to whose kindly Heat and Neighbourhood, the *Oriental Nations* are suppos'd to owe their Advantages. This also may be attempted in our *Northern Climates*: As for Instance, the *Flax*, of which we stand so much in need, may prosper in *Ireland* in many vast Tracts of Ground, now only possessed by wild *Beasts*, or *Tories* almost as wild.

o The second *Advancement* of this *Work* may be accomplish'd, by carrying and transplanting *living Creatures* and *Vegetables* from one *Oclimate* to another. This will be very beneficial, though it will be performed with a various Success. Sometimes the *Soil* and the *Air* being chang'd, will give a new Force to the new *Guests*; as the *Arabian Horse*, by mingling with our *Breed*, produces a more serviceable *Race* than either of them single. And sometimes the Alteration will be for the worse; as the *Vine* of *France* brought into *England*, and the *Horses* and *Dogs* of *England* into *France*; both of which are found to degenerate exceedingly: Their *Soil* and their *Sun*, it seems, being fitter to produce Things of *Pleasure* and *Delight*; and our *Air* and our *Earth* being more proper to beget *Valour* and *Strength*.

The third way of *Communication* to be try'd, is by removing the *Plants* and the Productions of the same *Country* from one part of it into another; and by practising every where all the sorts of *Husbandry*, which are us'd in some Places with Success. That this is not enough perfected even in *England*, is manifest to every one that beholds the *Kentish* Orchards, and the *Herefordshire* Hedges; which seem to upbraid the laziness of other Countries, whose High-ways are only fenc'd with Thorns and Briars, or at the best with Hazel; while theirs are beautify'd with Apples, Pears, and Cherries.

Now then, in every one of these *Transplantations*, the chief Progress that has hitherto been made, has been rather for the *Collection* of *Curiosities* to adorn *Cabinets* and *Gardens*, than for the Solidity of *Philosophical Discoveries*: Yet there may be a prodigious Advantage made in them all, both for the one end and

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the other. And in this it will be found, as in many other Things, that if Men only intend a little *Curiosity* and *Delight*, they will reap not much more by their Pains. But if they regard real Use, not only the *Profit*, but a greater *Delight* will also follow thereon.

And for our *Encouragement*, whatever Attempts of this Nature have succeeded, they have redounded to the great Advantage of the *Undertakers*. The *Orange* of *China* being of late brought into *Portugal*, has drawn a great *Revenue* every Year from *London* alone. The *Vine* of the *Rhine* taking Root in the *Canaries*, has produc'd a far more delicious Juice, and has made the *Rocks* and the *Sun-burnt Ashes* of those Islands, one of the richest Spots of Ground in the *World*. And I will also instance in that which is now in a good Forwardness; *Virginia* has already given *Silk* for the Cloathing of our *King*; and it may happen hereafter to give Cloaths to a great part of *Europe*, and a vast Treasure to our *Kings*; if the *Silk-worms* shall thrive there (of which there seems to be no doubt) the Profit will be inexpressible. We may guess at it, by considering what Numbers of *Caravans*, and how many great Cities in *Persia* are maintain'd by that *Manufecture* alone, and what mighty Customs it yearly brings into the *Sophi's Revenue*.

BUT if both these Helps should chance to fail; if nothing new should ever come into our Hands; and if there could be no farther Alteration made by *Transplanting*; yet we may still take Comfort, and rely on the old *Matter* itself, on which all our present *Arts* have been devised. This certainly will take away all distrust in this Business: For it may be observ'd, that the greatest part of all our *New Inventions* have not

§. XXIX.

Mechanics

improveable

by the old

Matter of

Arts. XX

been raised from Subjects before untouch'd (though they also have given us very many) but from the most studied and most familiar Things, that have been always in Mens Hands and Eyes. For this I shall only instance in *Printing*, in the *Circulation of the Blood*, in Mr. *Boyle's* Engine for the sucking out of *Air*, in the making of *Guns*, in the *Microscopical Glasses*, and in the *Pendulum Clocks* of *Hugenius*. What might we have believ'd to be perfect, if not the *Art* of Mens *Communicating* their Thoughts one to another? What was nearer to them than their *Blood*, by which their Life subsists? And what more ready to be found out than its *Motion*? In what Subject had the Wit of *Artificers* been more shewn, than in the variety of *Clocks* and *Watches*? What Thing was more in Mens View than *Glass*, through which, in these Countries, the very Light itself is admitted, whereby we discern all Things else? What more natural to us than the *Air* we breath, with which we form every word to express other Things? What was more studied than the *Art of Fighting*? What little *Stratagem*, or *Fortification*, or *Weapon*, could one have thought to have been conceal'd from the *Greeks* and *Romans*, who were so curious in the *Discipline* of War? And yet in all these the most obvious Things, the greatest Changes have been made by late *Discoveries*; which cannot but convince us, that many more are still to come from Things that are as common, if we shall not be wanting to ourselves.

§. XXX.
Mechanics
 improveable
 by the spread-
 ing of Civi-
 lity.

AND this we have good reason to trust will be effected, if this *Mechanic Genius*, which now prevails in these Parts of *Christendom*, shall happen to spread wider amongst ourselves, and other *Civil Nations*;

or

or if by some good Fate it shall pass farther on to other Countries that were yet never fully civiliz'd. We now behold much of the Northern Coasts of *Europe* and *Asia*, and almost all *Afric*, to continue in the rude State of *Nature* : I wish I had not an Instance nearer Home, and that I did not find some Parts of our own *Monarchy* in as bad a Condition. But why may we not suppose, that all these may in course of Time be brought to lay aside the untam'd Wildness of their present Manners? Why should we use them so cruelly as to believe, that the Goodness of their *Creator* has not also appointed them their Season of polite and happy Life, as well as us? Is this more unlikely to happen, than the Change that has been made in the *World* these last seventeen hundred Years? This has been so remarkable, that if *Aristotle*, and *Plato*, and *Demosthenes*, should now arise in *Greece* again, they would stand amaz'd at the horrible Devastation of that which was the *Mother of Arts*. And if *Cæsar* and *Tacitus* should return to Life, they would scarce believe this *Britain*, and *Gaul*, and *Germany*, to be the same which they describ'd : They would now behold them cover'd over with *Cities* and *Palaces*, which were then over-run with *Forests* and *Thickets* : They would see all manner of *Arts* flourishing in these Countries, where the chief *Art* that was practis'd in their Time, was that barbarous one of *painting their Bodies*, to make them look more terrible in *Battle*.

This then being imagin'd, that there may some lucky Tide of *Civility* flow into those *Lands*, which are yet savage, there will a double Improvement thence arise, both in respect of ourselves and them : For even the present *skilful* Parts of Mankind, will be thereby made more *skilful* ; and the other will not only

only increafe those *Arts* which we shall bestow upon them, but will also venture on new Searches themselves.)

If any shall doubt of the first of these *Advantages*, let them consider that the spreading of *Knowledge* wider, does beget a higher and a clearer *Genius* in those that enjoy'd it before.

But the chief Benefit will arise from the *New Converts*; for they will not only receive from us our *Old Arts*, but in their first Vigour will proceed to *new ones* that were not thought of before. This is reasonable enough to be granted: For seeing they come fresh and unwearied, and the Thoughts of Men being most violent in the first opening of their *Fancies*; it is probable they will soon pass over those Difficulties about which these People, that have been long *Civil*, are already tir'd. To this Purpose I might give as many *Examples* as there have been different *Periods* of *civilizing*; that those *Nations* which have been taught, have prov'd wiser and more dextrous than their *Teachers*. The *Greeks* took their first Hints from the *East*; but out-did them in *Music*, in *Statuary*, in *Graving*, in *Limning*, in *Navigation*, in *Horsemanship*, in *Husbandry*, as much as the *Agyptians* or *Assyrians* exceed their unskilful *Ancestors* in *Architecture*, *Astronomy*, or *Geometry*. The *Germans*, the *French*, the *Britains*, the *Spaniards*, the modern *Italians*, had their Light from the *Romans*; but surpass'd them in most of their own *Arts*, and well nigh doubled the ancient Stock of *Trades* deliver'd to their keeping!

§. XXXI.

Mechanics
are improve-
able by others
besides
Tradesmen.

So then, the whole *Prize* is not yet taken out of our Hands: The *Mechanic Invention* is not quite worn away, nor will be, as long as new Subjects may be discovered, as long as our old Materials may be alter'd

or

or improv'd, and as long as there remains any Corner of the *World* without *Civility*. Let us next observe, whether Men of different ways of Life are capable of performing any Thing towards it, besides the *Artificers* themselves. This will quickly appear undeniable, if we will be convinc'd by *Instances*; for it is evident, that diverse sorts of *Manufactures* have been given us by Men who were not bred up in *Trades* that resembled those which they discovered. I shall mention Three; that of *Printing*, *Powder*, and the *Bow-Dye*. The *admirable Art of Composing Letters*, was so far from being started by a Man of *Learning*, that it was the Device of a Soldier: And *Powder* (to make Recompence) was invented by a *Monk*, whose course of Life was most averse from handling the *Materials of War*. The ancient *Tyrian Purple* was brought to light by a *Fisher*; and if ever it shall be recover'd, it is likely to be done by some such Accident. The *Scarlet* of the *Moderns* is a very beautiful Colour; and it was the Production of a *Chymist*, and not of a *Dyer*.

And indeed the *Instances* of this kind are so numerous, that I dare in general affirm, That those Men who are not peculiarly conversant about any one sort of *Arts*, may often find out their *Rarities* and *Curiosities* sooner, than those who have their Minds confin'd wholly to them. If we weigh the *Reasons* why this is probable, it will not be found so much a *Paradox*, as perhaps it seems at the first Reading. The *Tradesmen* themselves, having had their Hands directed from their Youth in the same *Methods of Working*, cannot when they please so easily alter their Custom, and turn themselves into new Roads of Practice. Besides this, they chiefly labour for present Livelihood, and therefore cannot

cannot defer their *Expectations* so long, as is commonly requisite for the ripening of any *new Contrivance*. But especially having long handled their *Instruments* in the same Fashion, and regarded their *Materials* with the same Thoughts, they are not apt to be surpriz'd much with them, nor to have any extraordinary *Fancies*, or *Raptures* about them.

These are the usual Defects of the *Artificers* themselves: Whereas the Men of free Lives, have all the contrary Advantages: They do not approach those *Trades*, as their dull and unavoidable, and perpetual *Employments*, but as their *Diversions*: They come to try those *Operations*, in which they are not very exact, and so will be more frequently subject to commit Errors in their Proceeding: Which very Faults and Wandrings, will often guide them into new *Light*, and new *Conceptions*: And lastly, there is also some Privilege to be allow'd to the *Generosity* of their *Spirits*, which have not been subdu'd, and clogg'd by any constant *Toil*, as the others: *Invention* is an *Heroic Thing*, and plac'd above the reach of a low and vulgar *Genius*: It requires an active, a bold, a nimble, a restless *Mind*: A thousand Difficulties must be contemn'd, with which a mean Heart would be broken; many *Attempts* must be made to no Purpose; much *Treasure* must sometimes be scatter'd without any Return; much Violence and Vigour of Thoughts must attend it; some Irregularities and Excesses must be granted it, that would hardly be pardon'd by the severe *Rules of Prudence*. All which may persuade us, that a large and an unbounded Mind is likely to be the *Author* of greater *Productions*, than the calm, obscure, and fetter'd Endeavours of the *Mechanics* themselves: And that as in the *Generation of Children*, those are usually observ'd

observed to be most sprightly, that are the stolen Fruits of an unlawful *Bed*; so in the Generations of the *Brains*, those are often the most vigorous and witty, which Men beget on other *Arts*, and not on their own.

THIS came seasonably in, to stop the undeserv'd §. XXXII. Clamours, which perhaps in this humorous *Age*, some *Tradesmen* may raise against the *Royal Society*, for entering within the Compass of their Territories. Wherefore I proceed to my third *Particular*, which I have aim'd at in the two former, *that the surest Increase remaining to be made in Manual Arts, is to be perform'd by the conduct of Experimental Philosophy.* This will appear undeniable when we shall have found, that all other Causes of such *Inventions* are defective; and that for this very Reason, because the *Trials of Art*, have been so little united with the plain Labours of Mens Hands.

*Mechanics
best improvable
by Experiments.*

I have already given this Account of the former *Arts* that we use, that the greatest Part of them has been produc'd, either by *Luxury*, or *Chance*, or *Necessity*; all which must be confess'd to be mean and ignoble Causes of the *Rational Mechanics*.

The first of these has been, that Vanity and Intemperance of Life, which the delights of *Peace*, and greatness of *Empire* have always introduc'd. This has been the Original of very many extravagant *Inventions* of *Pleasure*; to whose *Promotion*, it is not requisite that we should give any help, seeing they are already too excessive. And indeed, if we consider the vast Number of the *Arts* of *Luxury*, compar'd to the sound, and the substantial ones of use; we shall find that the Wit of Men has been as much defective in

the one, as redundant in the other. It has been the constant Errors of Mens Labours in all *Ages*, that they have still directed them to improve those of *Pleasure*, more than those of *Profit*. How many, and how extravagant, have been the *Ornaments* about *Coaches*? And how few *Inventions*, about new Frames for *Coaches*, of about *Carts*, and *Ploughs*? What prodigious Expence has been thrown away, about the Fashions of *Cloaths*? But how little endeavours have there been to invent new *Materials* for *Cloathing*, or to perfect those we have? The *Furniture* and *Magnificence* of *Houses*, is risen to a wonderful Beauty within our Memory: But few or none have throughly studied the well-ordering of *Timber*, the hardning of *Stone*, the improvement of *Mortar*, and the making of better *Bricks*. The like may be shewn in all the rest: wherein the solid *Inventions* are wont to be overwhelm'd by *Gawdiness* and *Superfluity*; which Vanity has been caus'd by this, that the *Artists* have chiefly been guided by the Fancies of the Rich, or the Young, or of vain *Humorists*, and not by the *Rules* and *Judgments* of Men of *Knowledge*.

The second occasion that has given help to the Increase of *Mechanics* has been *Chance*: For in all *Ages*, by some casual Accidents, those Things have been reveal'd, which either Men did not think of, or else sought for in vain. But of this the *Benevolence* is irregular, and most uncertain: This indeed can scarce be styl'd the *Work* of a Man. The *Hart* deserves as much praise of *Invention*, for lighting on the Herb, that cures it; as the Man who blindly stumbles on any profitable *Work*, without Foresight or Consideration.

The last that I shall alledge is *Necessity*. This has given rise to many great *Enterprizes*; and like the
cruel

cruel Step-mother of *Hercules*, has driven Men upon *Heroic Actions*, not out of any tender Affection, but hard Usage. Nor has it only been an excellent Mistress to particular Men, but even to whole *States* and *Kingdoms*; for which reason some have preferr'd a *Barren Soil*, for the Seat of an *Imperial City*, before a *Fruitful*; because thereby the Inhabitants being compell'd to take Pains, and to live industriously, will be secure from the dangerous Inchantments of *Plenty* and *Ease*; which are fatal to the Beginnings of all Commonwealths. Yet the Defects of this severe *Author* of great *Works*, are very many. It often indeed engages Men in brave Attempts, but seldom carries them on to finish what they begin: It labours at first for want of *Bread*; and that being obtain'd it commonly gives over: It rather sharpens than enlarges Mens *Wits*; it sooner puts them upon small *Shifts*, than great *Designs*; it seldom rises to high or magnanimous Things; for the same necessity which makes Men *inventive*, does commonly depress and fetter their *Inventions*.

And now these principal Causes of *Mechanic Discoveries* being found for the greatest part to be either corrupt or weak: It is but just, that *Reason* itself should interpose, and have some Place allow'd it in those *Arts*, which ought to be the chief *Works* of *Reason*. It is a shame to the Dignity of *human Nature* itself, that either Mens Lusts should tempt them, or their Necessities drive them, or blind Fortune should lead them in the dark, into those Things in which consists the chief *Prerogative* of their Condition. What greater *Privilege* have Men to boast of than this; that they have the Pow'r of using, directing, changing, or advancing all the rest of the Creatures? This is the

Dominion which God has given us over the *Works* of his Hands. And if we will either answer the Expectations of *Heaven*, or deserve so high an Honour, we ought rather to manage this *Dominion* by *Diligence* and *Counsel*, than by *Chance*, or *Luxury*, or *Compulsion*.

It is impossible for us to administer this *Power* aright, unless we prefer the Light of Men of *Knowledge*, to be a constant Overseer and Director of the *Industry* and *Works* of those that labour. The Benefits are vast, that will appear upon this Conjunction. By this means the *Inventions* of *Chance* will be spread into all their various Uses, and multiply'd into many new Advantages: By this the *Productions* of *Necessity* will be amplify'd and compleated: By this those of *Luxury* and *Wantonness* may be reduc'd to some solid Ends: By this may be rais'd almost as certain a Method to invent new *Mechanics*, as now any particular *Mechanics* can practise, to produce their own *Operations*; by this the weak Minds of the *Artists* themselves will be strengthen'd, their low Conceptions advanc'd, and the Obscurity of their Shops enlighten'd: By this their Thoughts will be directed to better *Instruments* and *Materials*; by this their *Poverty* will be assisted, and they will be enabled to attempt more costly *Trials*; by this that will be amended, which has been hitherto the Misfortune of such *Inventions*, that they have commonly fallen into Mens Hands, who understand not their *Natures*, *Uses*, or *Improvements*: By this the Conceptions of Men of *Knowledge*, which are wont to soar too high, will be made to descend into the *material World*; and the flegmatick Imaginations of Men of *Trade*, which use to grovel too much on the Ground, will be exalted.

It was said of *Civil Government* by *Plato*, that then the World will be best rul'd, when either *Philosophers* shall be chosen *Kings*, or *Kings* shall have *Philosophical* Minds. And I will affirm the like of *Philosophy*; it will then attain to Perfection, when either the *Mechanic Labourers* shall have *Philosophical Heads*, or the *Philosophers* shall have *Mechanical Hands*; for the proof of this I need only propose one Instance, with which I am furnish'd by *Antiquity*; and it is of *Archimedes*; by this Example alone, we may at once chastise the sloth of all *Ages* since his time, and confute the present Contemners of *Mechanic Knowledge*. This *Great Man* was one of the first who apply'd his Skill, in the *Mathematics* and *Physics*, to the Practices and Motions of *Manual Trades*. And in these his Success was so prodigious, that the true Contrivances of his Hands did exceed all the *fabulous Strength*, which either the *ancient Stories*, or modern *Romances* have bestow'd on their *Heroes*. The *Weights* he mov'd were so vast, and the *Engines* he fram'd had such dreadful Effects, that his Force could neither be resisted by *Seas*, or *Mountains*, or *Fleets*, or *Armies*, which are the greatest Powers of Nature and Men. He alone sustain'd the Burden of his falling Country; he alone kept the *Romans* at a Bay, to whom the whole World was to yield. And perhaps he had come off victorious at last, if he had not contended with the fatal Valour of *Marcellus*: Amongst all whose Exploits, these are recorded as the two greatest, that he first shew'd that *Hannibal* might be subdu'd; and that he vanquish'd *Syracuse*, though it was defended by *Archimedes*.

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§. XXXIII.
*The Invention of new
 Mechanicks
 will not in-
 jure the old.*

THUS far I hope the way is clear as I go: I have some Confidence that I have sufficiently prov'd, that the *Invention of Trade* may still proceed farther, and that by the help of Men of free Lives, and by this course of *Experiments*. But yet the main *Difficulty* continues unremov'd. This arises from the suspicions of the *Tradesmen* themselves: They are generally infected with the narrowness that is natural to *Corporations*, which are wont to resist all *new Comers*, as profess'd Enemies to their *Privileges*: And by these interested Men it may be objected, That the growth of *new Inventions* and *new Artificers*, will infallibly reduce all the old ones to Poverty and Decay.

But to take off these *Fears* in this Particular, they are to be inform'd, that there are two sorts of *Experiments* which the *Royal Society* attempts in *Mechanical* Matters. The first will be employ'd about the revising, changing, and correcting of the old *Mechanicks* themselves: The second, about inventing of New. In the first of these they can have no ground of Jealousy; seeing they are not intended to bring others over their Heads, but only to beautify and fasten those which they already enjoy. And even this is a Work so necessary to be done, that if there were not a continual Reparation made in them, they would soon languish, and insensibly consume away into *Barbarism*: For the *Arts* of Mens Hands are subject to the same Infirmary with *Empire*, the best *Art* of their Minds, of which it is truly observ'd, that whenever it comes to stand still, and ceases to advance, it will soon go back and decrease.

Hence it appears, that one part of *Experiments*, and that a very considerable part, is free from their *Cavils*. Let us then go on to the other kinds, which

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Purpose the striking out of *new Mechanics*: Of these I will also assert the Innocence, in respect of their Predecessors. In few Words, the *Old Arts* are so far from being endanger'd by the *New*, that they themselves will receive a proportionable *Increase*, as the *New* shall arise. The Warmth and Vigour which attends new *Discoveries*, is seldom wont to confine itself to its own Sphere, but is commonly extended farther to the Ornament of its Neighbours. This is apparent in the Degree by which all *Nations* use to attain to a higher *Civility*. The ordinary Method wherein this happens, is the Introduction of some one or two *New Arts*: For they appearing with great Activity in the Beginning, do not only establish themselves; but also by stirring and inflaming Mens Minds, by disgracing the laziness of other *Artizans*, and provoking them to an Emulation, they are wont to bring an *universal Light* and *Beauty* on those *Inventions* into whose Company they are brought.

It is said of the *Moral Virtues*, that they have such a mutual Dependence, that no Man can attain to *Perfection* in any one of them, without some Degree of the other. And this also is certain in the *Mechanic Arts*: The Connexion between them is so close, that they generally use to increase in the same Measure. There is no Time, nor great City, which perfectly excels in any one of them, but it is thereby made more capable of admitting the rest, or of advancing them higher if they were admitted before.

It is true indeed, the increase of *Tradesmen* is an Injury to others, that are bred up in particular *Trades*, where there is no greater *Employment* than they can master: But there can never be an overcharge of *Trades*.

Trades themselves. That Country is still the richest and most powerful, which entertains most *Manufatures*. The Hands of Men employ'd are true *Riches*; the saving of those Hands by Inventions of *Art*, and applying them to other *Works*, will increase those *Riches*. Where this is done, there will never a sufficient Matter for Profit be wanting; for if there be not vent for their Productions at Home, we shall have it Abroad; but where the Ways of Life are few, the Fountains of Profit will be possess'd by few; and so all the rest must live in *Idleness*, on which inevitably ensues *Beggary*; whence it is manifest, that *Poverty* is caus'd by the fewness of *Trades*, and not by the multitude.

Nor is it enough to overthrow this, to tell us, that by this addition of *Labourers* all Things will become dearer, because more must be maintained: For the high rate of Things is an Argument of the Flourishing, and the cheapness of the Scarcity of Money, and ill peopling of all Countries. The first is a sign of many Inhabitants, which are true *Greatness*: The second is only a fit Subject for *Poets* to describe, and to compare to their *Golden Age*; for where all Things are without *Price* or *Value*, they will be without *Arts* or *Empire*, or *Strength*.

I will explain all this by a familiar and domestic *Instance*. It is probable that there are in *England* a hundred times more *Trades* than the *Saxons* or the *Danes* found here in their Invasions; and withal the particular *Traders* live now more plentifully, and the whole Nation is wonderfully stronger than before. This also may be seen in every particular *City*: The greater it is, the more kinds of *Artificers* it contains; whose Neighbourhood and Number is so far from being

ing an hindrance to each others Gain, that still the *Tradesmen* of most populous Towns are wealthier than those who profess the same Crafts in Country Mercats.

In *England* it has of late been a universal *Murmur*, that *Trade* decays; but the contrary is evident, from the perpetual Advancement of the *Customs*. Whence then arises the Complaint? From hence, that *Traders* have multiplied above the proportionable Increase of *Trades*: By this Means all the *old* Ways of Gain are over-stock'd, which would soon be prevented by a constant Addition of *new*.

The want of a right apprehending this, has always made the *English* averse from admitting of new *Inventions*, and shorter Ways of Labour, and from naturalizing new People: both which are the fatal Mistakes that have made the *Hollanders* exceed us in *Riches* and *Traffic*: they receive all *Projects* and all *People*, and have few or no *Poor*: We have kept them out and suppress'd them, for the Sake of the *Poor*, whom we thereby do certainly make the poorer.

And here there is suggested to me a just Occasion of lamenting the ill *Treatment* which has been most commonly given to *Inventors*, not only here in *England*, but in all *Ages* and *Countries*. Nor do they only meet with rough Usage from those that envy their Honour; but even from the *Artificers* themselves, for whose Sakes they labour: while those that add some small Matters to things begun, are usually enrich'd thereby; the *Discoverers* themselves have seldom found any other Entertainment than Contempt and Impoverishment. The Effects of their *Industry* are wont to be decry'd while they live: the Fruits of their *Studies* are frequently alienated from their Children;

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the little *Tradesmen* conspire against them, and endeavour to stop the Springs from whence they themselves receive Nourishment: The common Titles with which they are wont to be defam'd, are those of *Cheats* and *Projectors*. I cannot deny but many such do often mingle themselves in the noble Throng of *great Inquirers*; as of old there were some that imitated *Philosophers* only in Beard and Austerity: So I grant at this time there may false *Experimenters* and *Inventors* arise, who will strive to make themselves admir'd by the loud talking of *Mathematical Engines*, and *Glasses*, and *Tools*; and by sounding in every Place such goodly Words as *Chymistry*, and *Agriculture*, and *Mechanics*. But though the Folly of such *Pretenders* cannot be avoided, we must not therefore reject the sober and the judicious *Observers*. It is better sometimes to indure Vanities, than out of too much Niceness to lose any real *Invention*. We ought to do with *Philosophical Works*, as *Ministers of State* with *Intelligence*. It is the wisest Course to give Incouragement to all, least by shewing ourselves too scrupulous of being impos'd on by *Falshoods*, we chance to be depriv'd of the *Knowledge* of some important *Truths*.

The next *Particular* which I resolv'd to handle, is the Advantage of *Experiments* in respect of *Physic*. On this I intended to dilate in many Words, both because of the great weight of the *Subject*, which concerns the very Welfare and Health of our Lives, and also because it would afford me abundant matter for Discourse; for certainly it were easy to prove that there may still a vast Progress be made in the true *Art of Medicine*, if either we consider the imperfection of the *Method* of the *ancient Physicians*; or if we observe the Nature of *Diseases*, which alter and multi-

multiply upon us every *Age*; or if we reflect on the *Cures* themselves, and how little the *Invention* of new ones has hitherto been regarded.

But as I was entring on this *Subject*, I perceiv'd that I might safely omit it, seeing it is already better perform'd by Mr. *Boyle*, in his Book of the *Usefulness of Experimental Philosophy*. I will therefore withdraw my Pen from this matter, which this noble Gentleman has manag'd in the best and most powerful Way, by using not only the Force of *Reason*, but the Conviction of particular *Instances*.

AND NOW with so good an *Omen* as this Gentleman's *Example*, who has not disdain'd to adorn the Honour of his *Family* with the *Studies* of *Nature*; I will go on to recommend them to the *Gentry* and *Nobility* of our *Nation*. And I am the more encourag'd to make this Address, because I behold that what I would advise is already in good measure accomplish'd; so that I shall not only have an Occasion to *exhort* them to proceed, but to commend them also, for their present Zeal towards these *Endeavours*.

In this indeed I have much reason to applaud the *generous Breeding* which has been given to the *Experimental Knowledge* of this *Age* and *Country*, above the base and contemptible *Education* of the *Opinions* of all former *Sects*: for now *Philosophy* being admitted into our *Exchange*, our *Church*, our *Palaces*, and our *Court*, has begun to keep the best Company, and refine its Fashion and Appearance, and to become the Employment of the *Rich*, and the *Great*, instead of being the Subject of their *Scorn*: Whereas it was of old for the most part only the Study of the *Sullen* and the *Poor*, who thought it the gravest Part of

Science, to condemn the use of Mankind, and to differ in *Habit* and *Manners* from all others, whom they slighted as Madmen and Fools. From this arrogant Sordidness of such *Principles*, there could not be expected any *Magnificent Works*, but only ill-natur'd and contentious *Doctrines*. Whatever the *Poets* say of the *Moral Wisdom*, that it thrives best in *Poverty*; it is certain the *Natural* cannot: for in such mean and narrow Conditions, Men perhaps may learn to *despise* the World, but never to *know* it.

Now then, I will proceed not so much to exhort, as to confirm the *Gentlemen* of our *Nation*, in the prosecution of this *Art*, to which their *Purses* and their *generous Labours* are most necessary. And for their encouragement in this way, I will briefly lay before them the Privileges they have for such *Inquiries*, above all the *Gentry* of our Neighbour *Nations*, and above all the *Nobility* of former *Ages* in this *Kingdom*.

One principal Help that they enjoy, for the promoting of these *Studies* of Peace, is the present *Constitution* of the *Interest* of our *Government*. The chief Design of the *Antient English* was the Glory of spreading their Victories on the Continent: but this was a magnanimous Mistake: for by their very *Conquests*, if they had maintain'd them, this *Island* had been ruin'd, and had only become a *Province* to a greater *Empire*. But now it is rightly understood, that the *English* Greatness will never be supported or increased in this *Age* by any other Wars but those at *Sea*: and for these the Service of the Multitude is fitter than of Gentlemen. This we have beheld practis'd these last twenty Years, wherein our *Naval Strength* has more than trebled itself: for though some few *Gentlemen*

tlemen have still mingled themselves in those gallant Actions; yet the Gross of our *Fleets* have consisted of *common Men*, and of *Mariners* who are bred up in the rude Toils of such a Life.

As this *Observation* may raise us to the greater admiration of their *Valour*, that such *Magnanimity* should be found amongst the meanest of the People; so it should also suggest to our *Gentlemen*, who by this means are at liberty from the Employments of greatest Danger, that they ought to undertake these, which will give them as great, though a securer *Honour*. Nor will it be a Disgrace to them, that the fighting for their *Country* is cast on Men of lower Ranks, if in the mean time they shall strive to enlighten and adorn, while the other defend it: for the same is ordain'd by *Nature* itself in the Order and Offices of her *Works*; the *Heavenly Bodies* appear to move quietly above, to give Light, and to cherish the World with a gentle Influence; while the *Instruments of War* and *Offence* are taken out of the *Bowels* of the *Earth*.

For the Improvement of these *Arts of peaceable Fame*, they have indeed another Privilege, which can scarce be equall'd by any Kingdom in *Europe*; and that is, the Convenience and Benefit of being scatter'd in the *Country*. And in truth, the usual Course of Life of the *English Gentlemen* is so well plac'd between the troublesome Noise of pompous Magnificence, and the Baseness of avaricious Sordidness; that the true Happiness of living according to the Rules and Pleasures of uncorrupt *Nature*, is more in their power than any others. To them, in this way of Life, there can nothing offer itself which may not be turn'd to a *Philosophical Use*. Their *Country Seats* being remov'd from the Tumults of *Cities*, give them the best Opportunity.

— tunity, and Freedom of *Observations*. Their *Hospitality*, and familiar Way of conversing with their Neighbourhood will always supply them with Intelligence. The Leisure which their Retirements afford them, is so great, that either they must spend their Thoughts about such Attempts, or in more chargeable and less innocent *Divertisements*. If they will consider the *Heavens* and the Motions of the *Stars*, they have there a quieter *Hemisphere*, and a clearer *Air* for that Purpose. If they will observe the Generations, Breedings, Diseases, and Cures of *living Creatures*; their Stables, their Stalls, their Kennels, their Parks, their Ponds, will give them eternal Matter of Inquiry. If they would satisfy their Minds with the advancing of *Fruits*, the beautifying, the ripening, the bettering of *Plants*; their Pastures, their Orchards, their Groves, their Gardens, their Nurseries, will furnish them with perpetual *Contemplations*. They may not only make their *Business*, but their very *Sports* most serviceable to *Experimental Knowledge*. For that if it be rightly educated, will stand in need of such Recreations as much as the *Gentlemen* themselves, from their hunting, hawking, fishing, and fowling, that is able to receive as much solid Profit as they Delight.

— On both these Accounts the *English Gentry* has the Advantage of those of *France, Spain, Italy, or Germany*; who are generally either shut up in *Towns*, and dream away their Lives in the Diversions of *Cities*; or else are engag'd to follow their *Princes Wills* to foreign Wars.

Nor do they only excel other *Nations* in such Opportunities, but our own *Nobility* of all former Times. First, they are now far more numerous, and so more may be spar'd from the civil Business of their Country.

try. Besides this, they are now bred up and live in a quite different Fashion. The Course of their *Ancestors Lives* was grave and reserv'd: they convers'd with few, but their own Servants; and seldom travell'd farther than their own Lands: This way serv'd well enough to keep up their *State* and their *Port*; but not to help their Understandings. For the Formalities of *Life* do often counterfeit *Wisdom*, but never beget it. Whereas now they are engag'd in freer Roads of *Education*; now the vast Distance between them and other Orders of Men is no more observ'd; now their *Conversation* is large and general; now the *World* is become more *active* and *industrious*; now more of them have seen the Use and Manners of Men, and more apply themselves to *Trafic* and Business than ever.

This Alteration has been caus'd in our Memory, either by so many *Families* being advanc'd to the highest Degrees of *Nobility* for their excelling in the *Arts* of the *Gown*; or by their frequent Inter-marriages with *Citizens*; or by the Travels of the *King*, and the *Royal Family*; or else by the Civil War itself, which is always wont to be the cruelest *Tyrant*, or the best *Reformer*; either utterly to lay waste, or to civilize, and beautify, and ripen the *Arts* of all Countries. And still we have reason to expect, that this Change will proceed farther for the better, if our *Gentlemen* shall more condescend to engage in Commerce, and to regard the *Philosophy of Nature*.]

The first of these since the *King's* return, has been carry'd on with great Vigour by the *Foundation* of the *Royal Company*; to which as to the Twin-Sister of the *Royal Society*, we have reason as we go along to wish all *Prosperity*. In both these *Institutions* begun
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together, our *King* has imitated the two most famous *Works* of the wisest of ancient *Kings*; who at the same time sent to *Ophir* for *Gold*, and compos'd a *Natural History* from the Cedar to the Shrub.

Nor ought our *Gentry* to be averse from the promoting of *Trade*, out of any little Jealousy, that thereby they shall debase themselves, and corrupt their Blood: For they are to know, that *Trafic* and *Commerce* have given Mankind a higher Degree than any Title of *Nobility*, even that of *Civility* and *Humanity* itself. And at this time especially above all others, they have no reason to despise *Trade* as below them, when it has so great an influence on the very *Government* of the World. In former Ages indeed this was not so remarkable. The Seats of *Empire* and *Trade* were seldom or never the same. *Tyre*, and *Sydon*, and *Cades* and *Marseilles* had more *Trafic*, but less Command than *Rome*, or *Athens*, or *Sparta*, or *Macedon*. But now it is quite otherwise. It is now most certain that in those Coasts, whither the greatest *Trade* shall constantly flow, the greatest *Riches* and *Power* will be establish'd. The Cause of this Difference between the ancient Times and our own, is hard to be discover'd: perhaps it is this, that formerly the greatest Part of the *World* liv'd rudely on their own *Natural Productions*: but now so many *Nations* being civiliz'd, and living splendidly, there is a far greater Consumption of all *foreign Commodities*; and so the Gain of *Trade* is become great enough to over-balance all other Strength: Whether this be the *Reason* or no, it matters not; but the Observation is true. And this we see is sufficiently known to all our Neighbours, who are earnestly bent upon the advancing of *Commerce*, as the best means not only to enrich particular Merchants, but to enlarge the *Empire*.

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The next Thing to be recommended to the *Gentlemen* of *England* has a near Kindred with the other; and that is the *Philosophy* of *Nature* and *Arts*. For the want of such an easy Course of Studies, so many of them have miscarried in their first Years, and have ever after abhorr'd all manner of *sober Works*. What else do signify the universal Complaints of those who direct the *Education* of great Men's Children? Why do they find them so hard to be fix'd to any manner of *Knowledge*? Their Teachers indeed are wont to impute it to the delicacy of their Breeding, and to their *Mother's fondness*: But the chief Cause of the Mischiefs lies deeper: They fill their Heads with difficult and *unintelligible Notions*, which neither afford them Pleasure in Learning, nor Profit in remembering them; they chiefly instruct them in such *Arts*, which are made for the beaten Tracts of Professions, and not for *Gentlemen*. Whereas their Minds should be charm'd by the allurements of *sweeter* and more *plausible Studies*; and for this purpose *Experiments* are the fittest: Their *Objects* they may see and behold, their *Productions* are most popular; their *Method* is intelligible, and equal to their Capacities; so that in them they may soon become their own *Teachers*.

Nor are they to condemn them for their *Plainness*, and the homely *Matters* about which they are often employ'd. If they shall think scorn to foul their Fingers about them on this Account, let them cast their Eyes back on the *Original Nobility* of all Countries. And if that be true, that every Thing is preserv'd and restor'd by the same Means which did beget it at first; they may then be taught, that their present *Honour* cannot be maintain'd by intemperate *Pleasures*, or the gawdy Shews of Pomp, but by true *Labours* and

industrious Virtue. : Let them reflect upon those great Men who first made the Name of *Nobility* venerable ; and they shall find that amidst the *Government* of *Nations*, the Dispatch of *Armies*, and Noise of *Victories*, some of them disdain'd not to *work* with a Spade, to dig the *Earth*, and to cultivate with triumphing Hands the *Vine* and the *Olive*. These indeed were times, of which it were well if we had more Footsteps than in ancient *Authors*. Then the Minds of Men were innocent and strong, and bountiful as the *Earth* in which they labour'd. Then the Vices of human *Nature* were not their Pride, but their Scorn. Then *Virtue* was itself neither adulterated by the false Idols of *Goodness* ; nor puff'd up by the empty Forms of *Greatness* : As since it has been in some Countries of *Europe*, which are arriv'd at that *corruption* of *Manners*, that perhaps some severe *Moralists* will think it had been more needful for me to persuade the Men of this Age to continue Men, than to turn *Philosophers*.

But in this History I will forbear all farther *Complaints*, which were acceptable to the humour of this time, even in our *divine* and *moral Works*, in which they are necessary. I therefore return to that which I undertook, to the agreeableness of this design to all *Conditions* and *Degrees* of our *Nobility*. If they require such *Studies* as are proportionable to the greatness of their *Titles* ; they have here those Things to consider, from whence even they themselves fetch the Distinctions of their *Gentility*. The Minerals, the Plants, the Stones, the Planets, the Animals, they bear in their *Arms*, are the chief *Instruments* of *Heraldry*, by which those *Houses* are exalted above those of the *Vulgar* : And it is a shame for them to boast
of.

of the bearing of those Creatures they do not understand. If they value the *Antiquity of Families*, and long Race of *Pedigrees*; what can be more worthy their Consideration, than all the diverse Lineages of *Nature*? These have more proof of their ancient Descent than any of them can shew: For they have all continued down in a right Line, from *Cause to Effect*, from the *Creation* to this Day. If they shall confine themselves to the *Country*, they have this for their cheap Diversion. If they return to the *City*, this will afford them in every Shop occasions to inform their *Judgments*, and not to devour their *Estates*. If they go forth to *public Service*, to the leading of *Armies* or *Navies*, they have this for their perpetual Counselor, and very often for their Preserver. There are so many *natural* and *mechanical Things* to be accurately observ'd by the greatest Captains, as the Advantages of different Arms and Ammunitions, the Passages of Rivers, the Streights of Mountains, the Course of Tides, the Signs of Weather, the Air, the Sun, the Wind, and the like; that though I will not determine the *Knowledge of Nature* to be absolutely necessary to the great Office of a *General*; yet I may venture to affirm, that it will often prove a wonderful Assistance and Ornament to the course of *Glory* which he pursues.

All *Histories* are full of Examples of the great Accidents which have happen'd by the ignorance of chief Commanders in *natural Motions* and *Effects*; of these I will only instance in three: The first is of *Cesar* himself, who had conquer'd more *Countries* than most Travellers have seen, and gain'd more *Battles* than others have read of; yet he had like to have put a Period to all his *Victories*, by the want of an

exact Skill in one of the commonest *Works of Nature*. This he himself relates in his second Passage into *Britain*; when his Army was so dismay'd at the ebbing of the *Sea* from their Fleet, believing it to be a Stratagem of their *Enemies*; that scarce the Courage and Conduct of *Cesar*, could hinder them from being terrify'd to their own Overthrow, which had been a fatal Misfortune to the *Britains*, as well as *Romans*; because from his victorious Arms, we first receiv'd the dawn of *Civil Arts*. The next instance of this kind, is the Mischance which befel the *Christian Army* in *Egypt*, in the time of the *Holy Wars*: Their Strength was great and irresistible, if they had only understood, that which every *Egyptian* could have taught them, the Course, and the Time of the overflowing of the *Nile*. For the want of that slender Knowledge, the bravest Men of all *Christendom* were led up to the Neck in the River, and were forc'd to yield to their *Enemies* Conditions without striking a Stroke. This was occasion'd by the Stupidity of the *Cardinal* who commanded them; if he had been less skilful in the *Schoolmen*, and more in *Nature*, that dreadful Disaster had never happen'd. My third *Example* of this kind is to be found in the *Roman History*: The *Roman Army* was just ready to join Battle with one of their *Enemies*; the Sign was given for their Onset; their Force was equal; a terrible Combat had like to have ensu'd; when on a sudden the *Sun* was *Eclips'd*; of this the *Romans* were warn'd the Day before. But this surpriz'd the other with so great Affright; that they were immediately *vanquish'd*. So that not the bravest *Men*, nor the greatest *Army*, nor the best Provisions of *War* got the *Victory*; but that Party which had the best *natural Philosopher* on its side.

To this Address which I have made to our *Nobility* §. XXXV. and *Gentry*, I will add, as an Appendix, another Benefit of *Experiments*, which perhaps it will scarce be-
Experiments will be beneficial to our Wits and Writers.
 come me to name amidst so many Matters of greater Weight; and that is, that their Discoveries will be very serviceable to the *Wits* and *Writers* of this, and all future *Ages*. But this I am provok'd to mention by the Consideration of the present *Genius* of the *English Nation*; wherein the Study of *Wit*, and Humour of *Writing* prevails so much; that there are very few Conditions, or Degrees, or Ages of Men who are free from its Infection. I will therefore declare to all those whom this Spirit has possess'd, that there is in the *Works of Nature* an inexhaustible Treasure of *Fancy* and *Invention*, which will be reveal'd proportionably to the increase of their *Knowledge*.

To this purpose I must premise, that it is requir'd in the best, and most delightful *Wit*; that it be founded on such Images which are generally known, and are able to bring a strong and a sensible Impression on the *Mind*. The several Subjects from which it has been rais'd in all times, are the *Fables* and *Religions* of the *Antients*, the *civil Histories* of all *Countries*, the *Customs* of *Nations*, the *Bible*, the *Sciences* and *Manners* of *Men*, the several *Arts* of their Hands, and the *Works of Nature*. In all these, where there may be a resemblance of one thing to another, as there may be in all, there is a sufficient Foundation for *Wit*. This in all its kinds has its Increases, Heights, and Decays, as well as all other human Things: Let us then examine what Parts of it are already exhausted, and what remain new and untouch'd, and are still likely to be farther advanced.

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The *Wit* of the *Fables* and *Religions* of the *antient World* is well-nigh consumed; they have already serv'd the *Poets* long enough, and it is now high time to dismiss them, especially seeing they have this peculiar *Imperfection*, that they were only *Fictions* at first: Whereas *Truth* is never so well express'd or amplify'd, as by those *Ornaments* which are *true* and *real* in themselves.

The *Wit* which is rais'd from *Civil Histories*, and the Customs of *Countries*, is solid and lasting: The *Similitudes* it affords are substantial, and equal to the Minds of Men, being drawn from themselves and their own Actions. Of this the wittiest Nations have always made the greatest use; their Writings being adorn'd with a *Wit* that was free of their own *Cities*, consisting of *Examples*, and *Apothegms*, and *Proverbs*, deriv'd from their *Ancestors*. This I alledge, because this kind is scarce yet begun in the *English Language*; though our own *Civil History* abounds as much as any other, with great *Examples* and memorable Events, which may serve for the Ornament of Comparison.

The Manners, and Tempers, and Extravagances of Men are a standing and eternal Foundation of *Wit*: This if it be gather'd from particular *Observations*, is call'd *Humour*; and the more particular they are, they are still the pleasanter. In this kind I may well affirm that our *Nation* excels all others, as our *Dramatic Poetry* may witness.

The *Wit* that may be borrow'd from the *Bible* is magnificent, and, as all the other Treasures of *Knowledge* it contains, inexhaustible. This may be us'd and allow'd without any danger of Prophaneness. The *Antient Heathens* did the same; they made their *Divine Ceremonies*

Ceremonies the chief Subjects of their *Fancies*; by that means their *Religions* had a more awful impression, became more popular, and lasted longer in force than else they would have done; and why may not *Christianity* admit the same thing, if it be practis'd with *Sobriety* and *Reverence*? What Irreligion can there be in applying some *Scripture-Expressions* to *Natural Things*? Why are not the one rather exalted and purify'd, than the other defil'd by such Applications? The very *Enthusiasts* themselves, who are wont to start at such *Wit* as *Atheistical*, and more guilty of its Excesses than any other sort of Men: For whatever they alledge out of the *Historical*, *Prophetical*, or *Evangelical Writings*, and apply it to themselves, their Enemies, or their Country, though they call it the Mind of *God*, yet it is nothing else but *Scripture-Comparison* and *Similitude*.

The *Sciences* of Mens Brains are none of the best materials for this kind of *Wit*. Very few have happily succeeded in *Logical*, *Metaphysical*, *Grammatical*, nay even scarce in *Mathematical Comparisons*; and the reason is, because they are most of them conversant about Things remov'd from the Senses, and so cannot surprize the *Fancy* with very obvious, or quick, or sensible Delights.

The *Wit* that is founded on the *Arts* of Mens Hands, is masculine and durable: It consists of *Images* that are generally observ'd, and such visible Things which are familiar to Mens Hands. This therefore I will reckon as the first sort, which is still improvable by the Advancement of *Experiments*:

And to this I will add the *Works* of *Nature*, which are one of the best and most fruitful Soils for the growth of *Wit*. It is apparent, that the Defect of the

the *Antients* in *natural Knowledge*, did also strengthen their *Fancies*: Those few Things which they knew, they used so much, and applied so often, that they even almost wore them away by their using. The Sweetness of Flowers, and Fruits, and Herbs, they had quite devour'd; they had tir'd out the *Sun*, and *Moon*, and *Stars* with their Similitudes, more than they fancy them to be wearied by their daily Journey round the *Heavens*.

It is now therefore seasonable for *natural Knowledge* to come forth, and to give us the *Understanding* of new *Virtues* and *Qualities* of Things, which may relieve their Fellow-Creatures, that have long born the Burden alone, and have long been vex'd by the Imaginations of *Poets*. This charitable Assistance *Experiments* will soon bestow. The Comparisons which these may afford, will be intellible to all, because they proceed from Things that enter into all Mens Senses. These will make the most vigorous impressions on Mens *Fancies*, because they do even touch their *Eyes*, and are nearest to their *Nature*. Of these the Variety will be infinite, for the Particulars are so from whence they may be deduced: These may be always new and unfullied, seeing there is such a vast Number of *Natural* and *Mechanical Things*, not yet fully known or improved, and by Consequence not yet sufficiently applied.

The use of *Experiments* to this Purpose is evident, by the wonderful Advantage that my Lord *Bacon* receiv'd from them. This excellent Writer was abundantly recompenc'd for his noble Labours in that *Philosophy*, by a vast Treasure of admirable *Imaginations* which it afforded him, wherewith to express and adorn his Thoughts about other Matters. But I
will

will not confine this *Observation* to one single *Author*, though he was one of the first and most artificial Managers of this way of *Wit*. I will venture to declare in general of the *English Tongue*, that as it contains a greater Stock of *natural* and *mechanical Discoveries*, so it is also more enrich'd with beautiful *Conceptions*, and inimitable *Similitudes*, gather'd from the *Arts* of Men's Hands and the *Works of Nature*, than ever any other *Language* could produce.

And now I hope what I have here said will prevail something with the *Wits* and *Railleurs* of this *Age*, to reconcile their Opinions and Discourses to these *Studies*: for now they may behold that their Interest is united with that of the *Royal Society*; and that if they shall decry the promoting of *Experiments*, they will deprive themselves of the most fertile Subject of *Fancy*: and indeed it has been with respect to these terrible Men, that I have made this long Digression. I acknowledge that we ought to have a great Dread of their Power: I confess I believe that *new Philosophy* need not (as *Cæsar*) fear the pale or the melancholly, as much as the humorous and the merry: For they perhaps by making it ridiculous because it is *new*, and because they themselves are unwilling to take pains about it, may do it more Injury than all the Arguments of our severe and frowning and dogmatical *Adversaries*.

But to gain their good Will, I must acquaint them, that the Family of the *Railleurs* is deriv'd from the same Original with the *Philosophers*. The Founder of *Philosophy* is confess'd by all to be *Socrates*; and he also was the famous Author of all *Irony*. They ought therefore to be tender in this matter, wherein the Honour of their *common Parent* is concern'd: it be-

comes them to remember that it is the Fault, and not the Excellence of *Wit* to defile its own Nest, and not to spare its own Friends and Relations, for the Sake of a Jest.

The truth is, the Extremes of *Raillery* are more offensive than those of *Stupidity*: It is a Work of such a tender and subtil Spirit, that it cannot be decently perform'd by all Pretenders to it; nor does it always agree well with the Temper of our *Nation*; which as it has a greater Courage than to suffer *Derision*, so it has a firmer Virtue than to be wholly taken up about deriding of others. Such Men are therefore to know, that all things are capable of abuse from the same *Topicks* by which they may be commended; they are to consider, that Laughter is the easiest and the slenderest Fruit of *Wit*; they are to understand, that it proceeds from the Observation of the *Deformity* of things; but that there is a nobler and more masculine Pleasure, which is rais'd from beholding their *Order* and *Beauty*: From thence they may conclude, how great the Difference is between them and the real *Philosophers*; for while *Nature* has only form'd them to be pleas'd with its Irregularities and Monsters, it has given the other the Delight of knowing and studying its most *beautiful Works*.

In plain Terms, a universal Abuse of every thing, though it may tickle the Fancy never so much, is *inhuman Madneſs*; as one of the *Antients* well expresses it, who calls such Mirth *humanis Baccari rebus*. If all things were made the Subjects of such Humour, all worthy designs would soon be laugh'd out of the World; and for our present Sport, our *Posterity* would become barbarous. All good Enterprises ought to find Assistance when they are begun, Applause when they

they succeed, and even Pity and Praise if they fail. The true *Raillery* should be a Defence for *good* and *vertuous Works*, and should only intend the Derision of extravagant, and the Disgrace of vile and dishonourable Things. This kind of *Wit* ought to have the Nature of *Salt*, to which it is usually compar'd; which preserves and keeps sweet the good and sound Parts of all Bodies, and only frets, dries up, and destroys those Humours which putrify and corrupt.

This pleasant but unprofitable sort of Men being thus dismiss'd with this fair *Admonition*; it now follows in the last Place, that I examine the universal Interest of the *English Nation*, and consider what Effect the *Works* of the *Royal Society* are like to have upon it, by what means their *Labours* may serve to encrease our Advantages, and correct our Imperfections. In the Entrance of this Subject there are so many things presented to my Thoughts, which are worthy to be declar'd to my *Countrymen*, that I rather think it ought to be largely manag'd by itself, than to be huddled up in the end of this *Treatise*: and certainly there is scarce any matter that more deserves to be handled by the best of our *English Wits*, than the *Interest* of their *Country*. I do therefore take the Freedom to recommend it to their Hands; and to beseech them to raise their Thoughts from slighter Businesses, from unmanly Flatteries, or Vanities of *Love*, or useles *Burlesque*, to this grave and this noble *Argument*; and to remember that if *Themistocles* was in the right, when he preferr'd the making of a small City great before the playing on a Fiddle, then certainly it is the bravest Employment for a worthy Mind, to endeavour to make a great *Kingdom* greater.

Sect.
XXXVIII.
*Experiments
advantageous to the Interest of our Nation.*

There are very many Things in the *natural Genius* of the *English*, which qualify them above any other for a *governing Nation*. The Situation of our *Country* is most advantageous for *Command*: Its native Productions are most serviceable for *Strength* and *Empire*: The Disposition of the People is bold in Dangers, severe in Discipline, valiant in Arms, virtuous in Life, relenting to the Afflicted, and merciful in Conquest. The unfortunate Divisions by which our *Force* has been of late distracted, are but of one or two *Ages* growth; the Vices to which we are subject are not natural to our *Soil*, but imported hither from foreign *Countries*: The *English* Generosity, Fidelity, Magnanimity, Modesty, Integrity, they owe to themselves; their Luxury, their Debauchery, their Divisions, their spiritual Schisms, they have receiv'd from abroad.

And now what can be a greater Work than the Management of all these matters? Here the *Writer* might have occasion of doing right to the Honour of his *Country*, and yet reproving its Faults with a just Censure: he might explain the Weaknesses and Advantages of our *Kingdom*: he might remove the one, and confirm the other: he might compare the Actions of our *Ancestors* with the Manners of this *Time*, and shew by what degrees this Dissolution of *Goodness* crept in: he might with a generous and tender Hand, apply himself to the Cure of *Religious Distempers*: he might with irresistible *Arguments* attempt to amend what is amiss, restore the *good*, and by the Power of domestick Examples reduce us back to the antient Sincerity of *dealing*, and *innocence* of *Life*, and union of *Interests*.

The Desire of seeing this Work perform'd fits so much on my Mind, that I cannot but once more represent it
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to the Consideration of the many Eloquent and Judicious *Authors*, with whom our *Nation* is now more abundantly furnish'd than ever. But if neither the Necessity nor Usefulness of the Subject, nor the Benefit of their native Land will prevail with them to set upon it; it is my purpose to excite them by another way, which will indeed be hazardous to my own *Reputation*, yet perhaps may take effect. I will try the same Stratagem which I have often seen unskilful Singers use, to make those who have excellent Voices shew their *Art*: for as they by ill *Singing* some excellent Tune are wont to provoke the others to *sing*, when no Persuasions could move them; so do I intend at my first Leisure, by ill handling of this *noble Subject*, to stir up Men of greater Abilities to employ their Skill and their Judgment about it.

Having thus taken this Task on myself, it will not be needful here to insist long upon it before hand: I will only in a few Words declare, that it is the true Concernment of *England* to secure itself from the *Domination* of *Strangers*; both *Ecclésiastical* and *Temporal*; to advance its Industry in peaceful *Arts*; to increase its *People*; to improve its own *Manufactures*; to introduce the foreign, of which our Soil is capable; to make use of the two *Kingdoms* that are join'd with it under the same *Monarch*; for those Productions which grow not at Home; to obtain a Union of Mind; both in *Civil* and *Spiritual Matters*; and to preserve the antient Form of *Government*.

Of all these I will only touch upon those Parts of our *Interest* which have reference to the Design of the *Royal Society*.

The first thing that ought to be improv'd in the *English Nation*, is their *Industry*. This, it is true, has
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of late Years been marvellously advanc'd ; as may be shewn by the enlarging of *Traffic*, the spreading of many *Fruits*, the Plantations of *Trees*, and the great Improvement of *Manual Arts*. But it is evident, that it may still admit of farther Warmth and Activity ; as we may conclude, by the Want of Employment for younger Brothers, and many other Conditions of Men ; and by the number of our Poor, whom *Idleness* and not *Infirmities* do impoverish. The way to compass this, is not alone by *Acts of Parliament*, and good *Laws* ; whose Force will soon be evaded by present Craft and Interpretation, or else will be *antiquated* by Time. This perhaps our Country has found above all others : if our *Labourers* had been as diligent as our *Law-givers*, we had prov'd the most laborious Nation under *Heaven*. But the true Method of increasing *Industry*, is by that Course which the *Royal Society* has begun in *Philosophy*, by *Works* and *Endeavours*, and not by the Prescriptions of *Words*, or *Paper Commands*.

There is nothing whose promoting is so easy as *Diligence*, when it is once set on foot. This does not only propagate *Works* but *Workers* ; though at first it may begin on *Necessity*, yet it will afterwards proceed upon *Pleasure* : So that the farther it goes, the swifter it advances, because *willing Works* are sooner perform'd than those to which we are compell'd. This I will demonstrate by an *Instance* which I have already alledg'd, and it is of the *Hollanders* : for we may fetch *Examples of Virtue* from our own Countrymen, but of *Industry* from them. At first they were as lazy as the worst of ours : their Hands were unus'd to labour ; their manner of Life was much like that of the *antient Britains* ; their Coasts lay desolate to the Sea, with-

out Banks, or Towns, or Ships, or Harbours: and when the *Roman Emperor* gather'd Cockles there, perhaps there was little else worth gathering. But when by the number of their People they were forc'd to look abroad, to trade, to fish, to labour in *Mechanics*; they soon found the Sweetness as well as the Toil of their *Diligence*: their Successes and Riches still added new Heat to their Minds; and thus they have continued improving, till they have not only disgrac'd but terrify'd their *Neighbours* by their *Industry*. Nor will it suffice to tell us, that they owe this Activity to the Form of their *Government*. That Supposition may presently be confuted by the Example of *France*, the most absolute *Monarchy* of *Christendom*: There it is apparent by the prodigious Toils of their People, both upon the Earth, and in their Shops, that *Diligence* may thrive in a *Kingdom* as well as a *Commonwealth*.

And if ever the *English* will attain to the *Mastery* of *Commerce*, not only in *Discourse*, but *Reality*, they must begin it by their *Labours*, as well as by their *Swords*: they must do it by awakening their Minds, by rousing themselves from this Lethargy, by *Action*, by *Trials*, by *Working*: Unless this be done, they will in vain be *Victorious*: at the end of their *Wars* they will cool again, and lose all the Fruits of their *Valour*. The *Arts* of Peace, and their Improvements, must proceed in equal Steps with the Success of their *Arms*: The *Works* of our Citizens, our Plough-men, our Gardeners, our Wood-men, our Fishers, our Diggers in Mines, must be equally advanc'd with the *Triumphs* of our *Fleets*; or else their Blood will be shed in vain: they will soon return to the same Poverty, and want of *Trade*, which they strove to avoid. For as *Tully* professes, *neminem video eloquentem factum esse victoriâ*:

riâ: So will I affirm, *that we shall never be made Industrious by Victory alone.*

The second Thing to be corrected in the *English Humour*, is an Inclination to every *Novelty* and Vanity of foreign *Countries*, and a Contempt of the good things of our own. This Fondness is the usual Fault of young *Travellers*, but it has also ill Effects on Men of full *Age*: For this they are wont to alledge the Excuse of good *Breeding*. But if we could not study or understand our own Country, without the Imputation of ill Manners, good *Breeding* were the most pernicious thing in the World. For there was never yet any *Nation* great, which only admir'd the Customs of other People, and wholly made them the Pattern of their Imitation. This wandering and affected Humour *Experiments* will lessen above all other *Studies*: they will employ our Thoughts about our native Conveniences: they will make us intend our Minds on what is contained within our own Seas: and by considering and handling them more, will also make them more worthy of our Consideration.

The third *Imperfection* is on the other Extreme, and that is a *narrowness of Mind*, and a *pusillanimous confining* our Thoughts to ourselves, without regarding any thing that is foreign, or believing that any of their *Arts* or *Customs* may be preferr'd before our own. This indeed is a Perverseness, of which the *English* are not wholly to be acquitted: it being proper to *Islands*, and to such *Countries* that are divided from the rest of the *World*. This will be cur'd by the effectual *Demonstrations* that the *Society* will give of the Benefit of a universal *Correspondence* and *Communication*. And this, according to their Method, will be done without falling into the other Vice of affect-
ing

ing foreign *Habits*, and *Manners*, and *Gestures*. In these the *English* need not be beholden to others; but in their Fruits, in their Manufactures, in their Engines, in their Works in Gold, and Silver, and Brass, and Iron, we may follow their Practice, and emulate their Curiosities without Affectation.

There is one Instance which will shew how our Respect to outlandish Things is to be regulated. To depend on the *French* for every little Fashion of Cloaths, and to equal their *Nobility* in their way of Life, is neither for our Honour nor Profit. For the difference between their *Gentry* and ours, and their *Commonalty* and ours, is so great, that the same Manners will not be decent in us, which become them well enough. But to learn from them their *Skill* in *Horsemanship* and *Arms*, their *Building*, their *Cultivation of Fruits*, the *Parfimony* and *Industry* of their *Tradesmen*, is commendable; for in these Things we are defective, and they excel. It is therefore the Admiration of foreign *Extravagancies*, and not the Imitation of their *Excellencies* that is to be condemn'd. If we will rather obstinately be content with our own Store, than borrow what is good from Abroad; we flatter our selves with the same foolish Imaginations, that all *Countries* had, while they were barbarous. To them their *Acorns* and their *Cottages* were at first the utmost Ends of their Ambition. They knew no more, nor aspir'd to any farther Addition; but as soon as a new Light sprung forth amongst them, they despis'd themselves and their former Condition; and then they first began to understand their *Wants*, when they perceiv'd how they might be supply'd. As long as we find that all parts of our *Country* are not Ingenious, Inventive, and Industrious alike, we cannot presume that we

have already got beyond all possibility of *Amendment* by others Patterns. As long as we behold any *City* or *Province*, or *Family*, or *Street* of our Neighbours, exceed the worst of ours, I will not say the best in Easiness of *Life*, or Pleasantness or Smoothness of *Manners*, we have no reason to arrogate too much to our selves; but we rather should conceive it to be a less disgrace to tread in their *Footsteps*, than to want their Perfections. As long as there remains any room for our most civil *People* to grow more *Civil*, the Introduction of foreign *Inventions* is not only *pardonable*, but *necessary*; for such is the Nature of *Civility*, that as it increases, it still requires more *Arts*, though it contents itself with less Forms of living.

The fourth Mischief by which the Greatness of the *English* is suppress'd, is a want of Union of *Interests* and *Affections*. This is originally caus'd by a natural Reservedness, to which our Temper is inclin'd; but it has been heighten'd by our *Civil Differences*, and *Religious Distractions*. For the sweetning of such Dissensions, it is not best at first to meet and converse about Affairs of State, or spiritual Controversies. For those did first occasion our *Animosities*, and the more they are rubb'd, the rawer they will prove. But the most effectual Remedy to be us'd, is, first to assemble about some *calm* and *indifferent* Things, especially *Experiments*. In them there can be no cause of mutual *Exasperations*: In them they may agree, or dissent without Faction or Fierceness; and so from enduring each others *Company*, they may rise to a bearing of each others *Opinions*; from thence to an exchange of good *Offices*; from thence to real *Friendship*: Till at last by such a gentle and easy *Method*, our several *Interests*,

terests and *Sects* may come to suffer one another, with the same Peaceableness as Men of different *Trades* live one by another in the same *Street*.

Nor is it the least Commendation the *Royal Society* deserves, that designing a Union of Mens *Hands* and *Reasons*, it has proceeded so far in uniting the *Affections*; for there we behold an unusual Sight to the *English Nation*, that Men of disagreeing Parties, and ways of Life, have forgotten to hate, and have met in the unanimous Advancement of the same *Works*. There the *Soldier*, the *Tradesman*, the *Merchant*, the *Scholar*, the *Gentleman*, the *Courtier*, the *Divine*, the *Presbyterian*, the *Papist*, the *Independant*, and those of *Orthodox Judgment*, have laid aside their Names of Distinction, and calmly conspir'd in a mutual Agreement of *Labours* and *Desires*: A Blessing which seems even to have exceeded that Evangelical Promise, *That the Lion and the Lamb shall lie down together*; for here they do not only endure each others Presence without Violence or Fear, but they *work* and *think* in Company, and confer their help to each others *Inventions*.

THE last part of the *general Interest* of our *Nation*, §. XXXIX. in which I will survey the influence of *Experiments*, *Experimental Knowledge will* is *Obedience to the Civil Government*; and we ought *not hinder* to be very watchful that they prove not offensive to *Obedience*. the *Supreme Power*; for seeing the *King* has honour'd them with his *Royal Patronage*, it is but just that the *Prerogatives* of his *Crown* should be no losers by their Increase. It is indeed a common Accusation, which is wont to be made against all manner of *Knowledge*, by those who have it not, that it renders Men mutinous, arrogant, and incapable of *Superiors*; but if this be

admitted, we shall asperse *human Nature* and *Government* with the greatest Calumny. This were to affirm, that Men cannot exercise their *Reason* without being *Factionous* and *Unruly*; and that *Civil Government* will be insupportable to all but ignorant Men and Fools; which is so far from being true, that it were easy to prove that those *Nations* which are void of all *Arts* and *Knowledge*, cannot be properly said to pay a right *Obedience* to their *Sovereigns*; but that the Subjection under which they live, rather deserves to be styl'd the Stupidity and Slavery of Beasts, than a just and a manly Submission.

But to limit this Question to the particular kind of *Knowledge*, which is now under debate, it is certain that the Skill of *Nature* ought so little to be suspected for making Men perverse and ungovernable, that it is the best Preservative against *Disobedience*. One of the principal Causes of this is a misguided *Conscience*, and opposing the pretended Dictates of *God* against the Commands of the *Sovereign*. This I have already shewn, that these *Labour's* will moderate and reform by abolishing or restraining the Fury of *Enthusiasm*. Another is idle Poverty, which drives Men into Sullenness, Melancholy, Discontent, and at last into resistance of *lawful Authority*. To this *Experiments* will afford a certain Cure; they will take away all pretence of Idleness, by a constant course of pleasant Endeavours; they will employ Men about profitable *Works*, as well as *delightful*; by the Pleasure of their *Discoveries* they will wear off the Roughness, and sweeten the humorous Peevishness of Mind, whereby many are sow'd into *Rebellion*.

But the most fruitful Parent of *Sedition* is *Pride*, and a lofty conceit of Mens own *Wisdom*; whereby they

they presently imagine themselves sufficient to direct and censure all the *Actions* of their *Governors*. And here that is true in *Civil Affairs*, which I have already quoted out of my Lord *Bacon* concerning *Divine*: A little *Knowledge* is subject to make Men headstrong, insolent, and untractable; but a great deal has a quite contrary Effect, inclining them to be submissive to their *Betters*, and obedient to the *Sovereign Power*.

The *Science* that is acquir'd by *Disputation*, teaches Men to cavil well, and to find fault with accurate Subtilty; it gives them a fearless Confidence of their own Judgments; it leads them from contending in Sport, to Oppositions in earnest; it makes them believe that every thing is to be handled for and against, in the *State*, as well as in the *Schools*. But the unfeign'd and laborious *Philosophy* gives no Countenance to the vain Dotages of private *Politicians*; that bends its *Disciples* to regard the Benefit of Mankind, and not the Disquiet; that by the Moderation it prescribes to our Thoughts about *Natural Things*, will also take away all sharpness and violence about *Civil*; the *Work* of that is so vast, that it cannot be perform'd without the Assistance of the *Prince*; it will not therefore undermine his *Authority* whose Aid it implores; that prescribes a better way to bestow our time, than in contending about little Differences, in which both the Conquerors and the Conquer'd have always reason to repent of their Success; that shews us the difficulty of ordering the very Motions of senseless and irrational Things; and therefore how much harder it is to rule the restless Minds of Men; that teaches Men *Humility*, and acquaints them with their own *Errors*; and so removes all overweening Haughtiness of Mind, and swelling Imaginations, that they are better able

to manage Kingdoms than those who possess them. This, without question, is the chief Root of all the uneasiness of *Subjects* to their *Princes*. The World would be better govern'd, if so many did not presume that they are fit to sustain the Cares of *Government*. Transgression of the *Law* is *Idolatry*: The Reason of Mens contemning all *Jurisdiction* and *Power*, proceeds from their idolizing their own *Wit*; they make their own Prudence omnipotent; they suppose themselves *infallible*; they set up their own *Opinions*, and worship them. But this vain *Idolatry* will inevitably fall before *Experimental Knowledge*; which as it is an *Enemy* to all manner of false *Superstitions*, so especially to that of Mens adoring themselves, and their own Fancies.

Sect. XL.
The Conclusion, being a general Recommendation of this Design.

I HAVE now at last brought my Reader by a tedious Compass, to the end of our Journey: And here I desire him to look back, and to make a Reflection on the Matters of which I have treated. In the first part of my Discourse I have alledg'd the Causes by which these *Studies* were suppress'd in all former *Ages*; which have been Interests of *Sects*, the Violence of *Disputations*, the plausible Arts of *Speech*, the *Religious Controversies*, the *Dogmatical Opinions*, the *Poverty* of the *Undertakers*, and the want of a continual Race of *Experimenters*. In the second I have shew'd by what Steps the *Royal Society* arose, what it has propos'd to attempt, what Course it has taken to make its *Observations* universal and perpetual; what Assistance has been afforded it to that Purpose, and about what Particulars it has been conversant. In the third I have try'd to free it from the false Scandals of *Ignorance*, and the Prejudices of several ways of Life, and

to prove that its Effects will more immediately refer to our own Country.

My Reader now beholds an Assembly settled of many eminent Men of all Qualities, who have engag'd to bestow their Labours on a design so publick, and so free from all Suspicion of mean or private Interest. What Foundation they have within themselves, for defraying the Expence of their *Trials* and *Intelligence*, may be guess'd by their *Number*, which at this present amounts very near to *two Hundred*; as appears by this following *Catalogue*, which I have rang'd *Alphabetically*.

The King's Majesty, Founder and Patron.

His Royal Highness the Duke of York:

His Highness Prince Rupert.

His Highness Ferdinand Albert, Duke of
Brunswick and Lunenburgh.

The Duke of Albemarle, the Earl of Ailsbury, the Earl of Argile, the Lord Ashley, the Lord Annesly, Mr. Ashmole, Sir Robert Atkins, Mr. Austin, Mons. Auzout, Mr. Awbrey.

The Duke of Buckingham, the Lord George Berkeley, the Lord Brereton, Mr. Bagnal, Mr. Bains, Mr. William Balle, Mr. Isaac Barrow, Dr. George Bate, Dr. Bathurst, Dr. Beal, Mons. Beaufort de Frafras, Sir John Birkenhead, Mr. Blunt, Mr. Boyle, Mr. Brook, Dr. Bruce, Mons. Bullialdus, Mr. Burnet, Sir Edward Byshe.

The Lord Archbishop of Canterbury; the Earl of Clarendon, Lord Chancellor of England; the Earl of Carlisle, the Earl of Crasford and Lindsay, the Lord Cavendish, the Lord Clifford, Mr. Carkefs, Mr. Carter et
Dr.

The HISTORY of

Dr. *Charleton*, Sir *Winstone Churchill*, Sir *John Clayton*, Sir *Clifford Clifton*, Mr. *George Cock*, Sir *Richard Corbet*, Dr. *Cotton*, Dr. *Cox*, Mr. *Thomas Cox*, Mr. *Daniel Cox*, Mr. *Creed*, Mr. *Crispe*, Sir *John Clutter*.

The Marquess of *Dorchester*, the Earl of *Devonshire*, the Earl of *Dorset*, Monf. *Vital de Damas*, Sir *George Ent*, Mr. *Ellise*, Mr. *John Evelyn*, Sir *Francis Fane*, Monf. *le Febvre*, Sir *John Finch*, Mr. *Henry Ford*, Sir *Bernhard Gascoigne*, Mr. *Joseph Glanville*, Dr. *Glifson*, Mr. *William Godolphin*, Mr. *Graunt*.

The Lord *Hatton*, Mr. *Haak*, Mr. *William Hammond*, Mr. *William Harrington*, Sir *Edward Harley*, Sir *Robert Harley*, Mr. *Harley*, Dr. *Henshaw*, Monf. *Hevelius*, Mr. *Abraham Hill*, Mr. *Hoar*, Dr. *Holder*, Mr. *Hook*, Mr. *Charles Howard*, Monf. *Huygens*.

Mr. *Richard Jones*, the Earl of *Kincardin*, Sir *Andrew King*, Mr. *Edmund King*, the Earl of *Lindsey*, the Lord Bishop of *London*, Mr. *Lake*, Sir *Ellis Leighton*, Mr. *James Long*, Sir *John Lowther*, Mr. *Lowther*, Monf. *Hugues de Lyonne*.

The Earl of *Manchester*, Monf. *Nicholas Mercator*, Dr. *More*, Dr. *Jasper Needham*, Dr. *Needham*, Mr. *Thomas Neile*, Mr. *William Neile*, Mr. *Nelthorp*, Mr. *Newburgh*, Sir *Thomas Nott*, the Earl of *Peterburgh*, Mr. *Packer*, Mr. *Samuel Parker*, Sir *Robert Paston*, Dr. *John Pearson*, Dr. *Pell*, Sir *William Persall*, Sir *Peter Pett*, Mr. *Peter Pett*, Monf. *Petit*, Sir. *William Portman*, Mr. *Francis Potter*, Mr. *Povey*, Dr. *Power*, Sir *Richard Powle*, Mr. *Pepys*,

The Lord *Roberts* Lord *Privy Seal*, the Lord Bishop of *Rocheſter*, Mr. *Rolt*, Mr. *Rycant*, the Earl of *Sandwich*, the Lord Viſcount *Stafford*, the Lord *Stermont*, Mr. *Schroter*, Sir *James Shaen*, Mr. *Skippon*, Sir *Nicholas Slaney*, Mr. *Henry Slingsby*, Mr. *Smethwick*, Mr.

Edward

Edward Smith, Dr. *George Smith*, Monf. *Sorbiere*, Sir *Robert Southwell*, Mr. *Alexander Stanhope*, Mr. *Thomas Stanley*.

The Earl of *Tweedale*, Sir *Gilbert Talbot*, Sir *John Talbot*, Dr. *Terne*, Mr. *Thomas Thyn*, Dr. *Thruston*, Sir *Samuel Tuke*, Sir *Theodore de Vaux*, Mr. *Vermuyden*, Monf. *Isaac Vossius*.

The Lord Bishop of *Winchester*, Mr. *Waller*, Dr. *Wallis*, Mr. *Waterhouse*, Dr. *Whistler*, Mr. *Joseph Williamson*, Dr. *Willis*, Mr. *Francis Willoughby*, Mr. *Wind*, Mr. *Winthorp*, Mr. *Woodford*, Mr. *Matthew Wren*, Dr. *Thomas Wren*, Sir *Cyril Wyche*, Sir *Peter Wyche*, Mr. *Wylde*, the Lord Archbishop of *York*, the Lord *Yester*.

The present *Council* are these that follow :

William Lord Viscount *Brouncker*, President; which Office has been annually renew'd to him by Election, out of the true Judgment which the *Society* has made of his great *Abilities* in all *Natural*, and especially *Mathematical Knowledge*.

Mr. *William Aerskin*, Dr. *Peter Ball*, Dr. *Timothy Clerk*, Mr. *Daniel Colwall*, Dr. *Croon*, the Lord Bishop of *Exeter*, Dr. *Jonathan Goddard*, Mr. *Henry Howard* of *Norfolk*, Mr. *Henshaw*, Mr. *Hoskins*, Sir *Robert Moray*, Sir *Anthony Morgan*, Dr. *Merret*, the Earl of *Northampton*, Sir *Paul Neile*, Mr. *Oldenburgh*, Sir *William Petty*, Dr. *Pope*, Dr. *Wilkins*, Dr. *Christopher Wren*.

In this number perhaps there may some be found, whose *Employments* will not give them leave to promote these *Studies* with their own *Hands*. But it being their Part to *contribute* jointly towards the *Charge*, and to pass *Judgment* on what others shall

try; they will appear to be well nigh as useful as those that *labour*, to the main End of this *Enterprize*.

Whatever *Revenue* they shall raise by this or any other means, they intend thereby to make an Establishment for their *Curators*. To this Office they have already admitted some of their *Fellows*, whom they will employ according to their *Studies* and *Sufficiency*: Some shall be sent to travel abroad to search for *Discoveries*; some shall constantly remain in *London*, and represent their *Observations* to the weekly *Assemblies*.

The Places of their *Residence* they have appointed to be two: one a *College*, which they design to build in *London*, to serve for their *Meetings*, their *Laboratories*, their *Repository*, their *Library*, and the Lodgings for their *Curators*: The other the *College* at *Chelseä*, which the *King* has bestow'd on them; where they have a large Inclosure to serve for all *Experiments* of *Gardening* and *Agriculture*; and by the neighbourhood of the *River* they have excellent Opportunity of making all *Trials* that belong to the Water.

And now as I have spoken of a *Society* that prefers *Works* before *Words*, so it becomes their *History* to endeavour after real *Fruits* and *Effects*. I will therefore conclude, by recommending again this *Undertaking* to the *English Nation*; to the *bravest People*, the most *generous Design*; to the most zealous Lovers of *Liberty*, the surest Way to ransom the Minds of all Mankind from *Slavery*.

The Priviledges that our *King's Dominions* enjoy for this End, appear to be equal'd by no other *Country*. The Men that we have now living to employ, are excellently furnish'd with all manner of Abilities: Their Method is already settled, and plac'd out of the reach of Calumny or Contradiction.

The Work itself indeed is vast, and almost incomprehensible, when it is consider'd in Gross: But they have made it feasible and easy, by distributing the Burden. They have shewn to the World this great Secret, That *Philosophy* ought not only to be attended by a select Company of *refin'd Spirits*. As they desire that its Productions should be *vulgar*, so they also declare, that they may be promoted by *vulgar Hands*. They exact no extraordinary Preparations of *Learning*; to have found *Senses* and *Truth*, is with them a sufficient Qualification. Here is enough Business for *Minds* of all Sizes: And so boundless is the Variety of these *Studies*, that here is also enough Delight to recompence the Labours of them all, from the most ordinary Capacities, to the highest and most searching *Wits*.

Here first they may take a plain View of all particular Things, their Kinds, their Order, their Figure, their Place, their Motion: and even this naked Prospect cannot but fill their Thoughts with much Satisfaction, seeing it was the first Pleasure which the *Scripture* relates *God* himself to have taken at the *Creation*; and that not only once, but at the end of every Day's Work, when he saw all that he had made, and approv'd it to be good. From this they may proceed to survey the Difference of their Composition, their Effects, the Instruments of their Beings and Lives, the Subtilty and Structure, the Decay and Supply of their Parts; wherein how large is the space of their Delight, seeing the very Shape of a *Mite*, and the Sting of a *Bee* appears so prodigious. From hence they may go to apply Things together, to make them work one upon another, to imitate their Productions, to help their Defects, and with the noblest Duty to assist Na-

turè, our common Mother, in her *Operations*; from hence to all the works of Mens hands, the divers *Artifices* of several *Ages*, the various Materials, the improvement of *Trades*, the advancement of *Manufactures*; in which last alone there is to be found so great Content, that many mighty Princes of the former and present Times, amidst the pleasures of *Government*, which are no doubt the highest in the World, have striven to excel in some *Manual Arts*.

In this spacious Field their *Observations* may wander, and in this whatever they shall meet with, they may call their own. Here they will not only enjoy the cold contentment of *Learning*, but that which is far greater, of *Discovering*. Many things that have been hitherto hidden, will arise and expose themselves to their view; many Methods of advancing what we have already, will come in their way; nay, even many of the lost *Rarities* of *Antiquity* will be hereby restor'd. Of these a great quantity has been overwhelm'd in the ruins of *Time*; and they will sooner be retriev'd by our labouring anew in the material Subjects whence they first arose, than by our plodding everlastingly on the antient *Writings*. Their *Inventions* may be soonest regain'd the same way by which their *Medals* and *Coins* have been found; of which the greatest part has been recover'd, not by those who sought for them on purpose in old Rubbish, but by digging up Foundations to raise new Buildings, and by plowing the Ground to sow new Seed.

This is the *Work* we propose to be encourag'd, which at once regards the discovering of new *Secrets*, and the purifying and repairing all the profitable Things of *Antiquity*. The Supply that is needful to finish it, will neither impoverish Families, nor exhaust

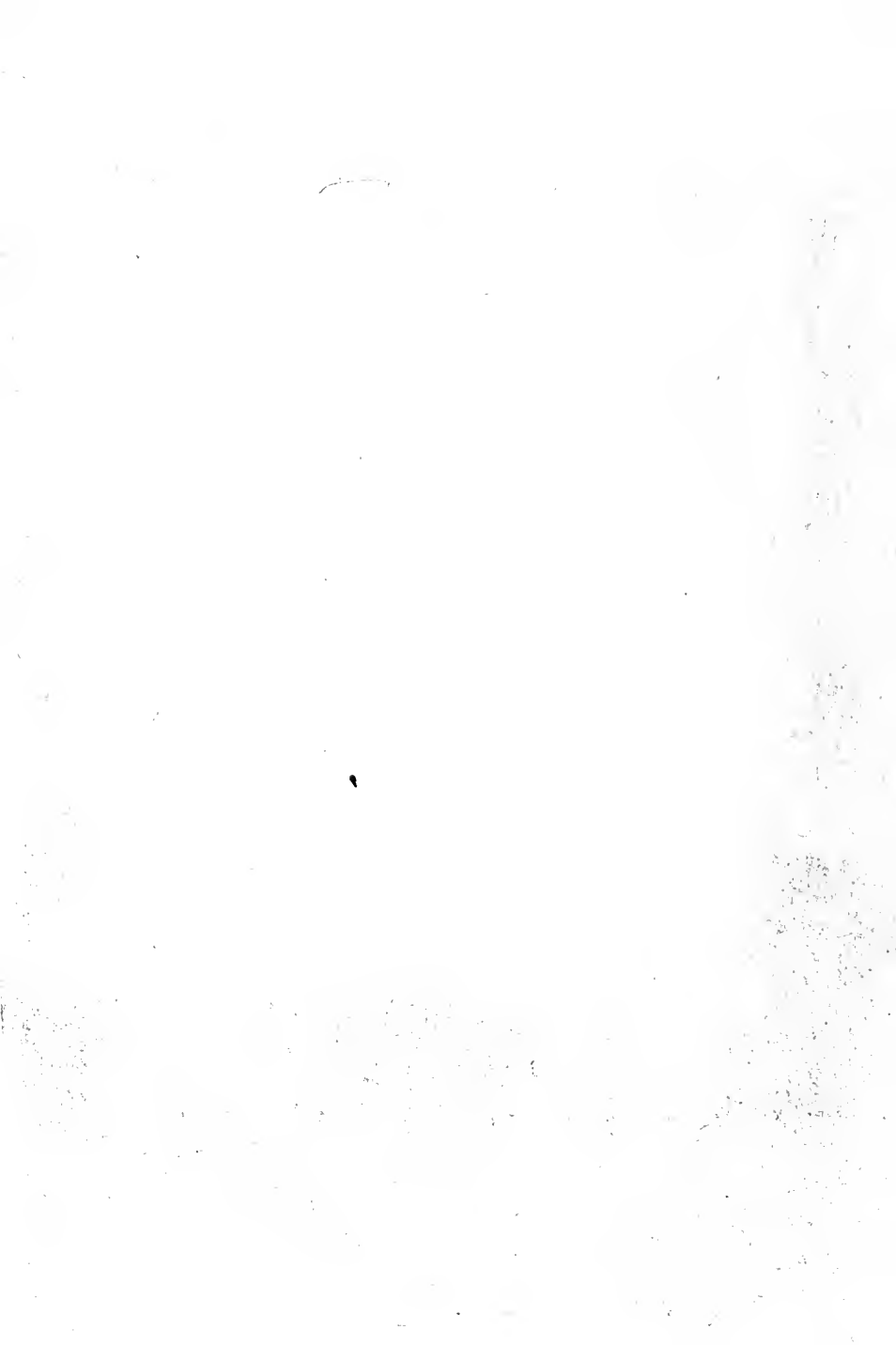
haust a mighty Income. So near is Mankind to its Happiness, that so great an *Attempt* may be plentifully endow'd by a small part of what is spent on any one single Lust, or extravagant Vanity of the Time. So moderate is the *Society* in their desires of Assistance, that as much Charity as is bestow'd in *England* in one Year, for the relief of particular Poverty and Diseases, were enough for ever to sustain a *Design*, which endeavours to give Aid against all the Infirmities and Wants of *human Nature*.

If now this *Enterprize* shall chance to fail for want of *Patronage* and *Revenue*, the World will not only be frustrated of their present Expectations, but will have just ground to despair of any future *Labours*, towards the increase of the *Practical Philosophy*. If our *Posterity* shall find, that an *Institution* so vigorously begun, and so strengthen'd by many signal Advantages, could not support itself; they will have reason in all times to conclude, That the long barrenness of *Knowledge* was not caus'd by the corrupt Method which was taken, but by the Nature of the *Thing* itself. This will be the last great Endeavour that will be made in this way, if this shall prove ineffectual; and so we shall not only be guilty of our own *Ignorance*, but of the *Errors* of all those that come after us.

But if (as I rather believe and presage) our *Nation* shall lay hold of this Opportunity, to deserve the applause of Mankind, the force of this *Example* will be irresistibly prevalent in all *Countries* round about us; the State of *Christendom* will soon obtain a new Face: while this *Halcyon Knowledge* is breeding, all *Tempests* will cease; the Oppositions and Contentious Wranglings of *Science*, falsely so call'd, will soon vanish

vanish away ; the peaceable calmness of Mens *Judgments* will have admirable influence on their *Manners* ; the sincerity of their *Understandings* will appear in their *Actions* ; their *Opinions* will be less violent and dogmatical, but more certain ; they will only be *Gods* one to another, and not *Wolves* ; the value of their *Arts* will be esteemed by the *great Things* they perform, and not by those they speak : While the old *Philosophy* could only at the best pretend to the Portion of *Neptthali*, to give goodly words, the New will have the Blessings of *Joseph* the younger and the belov'd Son ; *It shall be like a fruitful Bough, even a fruitful Bough by a Well whose Branches run over the Wall : It shall have the Blessings of Heaven above, the Blessings of the Deep that lies under, the Blessings of the Breasts and of the Womb :* While the Old could only bestow on us some barren Terms and Notions, the New shall impart to us the *Uses* of all the *Creatures*, and shall enrich us with all the Benefits of *Fruitfulness* and *Plenty*.

F I N I S.



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